September, 1988

South Shore Water Supply Protection Study

Metropolitan Area Planning Council
110 Tremont Street
Boston, MA 02108

SOUTH SHORE WATER SUPPLY PROTECTION STUDY

SEPTEMBER, 1988

METROPOLITAN AREA PLANNING COUNCIL
BOSTON, MASSACHUSETTS

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ABOUT THIS REPORT

This report was prepared by the staff of the Metropolitan Area Planning Council under the supervision of the Executive Director. The Metropolitan Area Planning Council is the officially designated regional planning agency for 101 cites and towns in the Boston metropolitan area. The Council offers technical assistance to its member communities in the areas of land use, housing, environmental quality, energy, transportation, and economic development.

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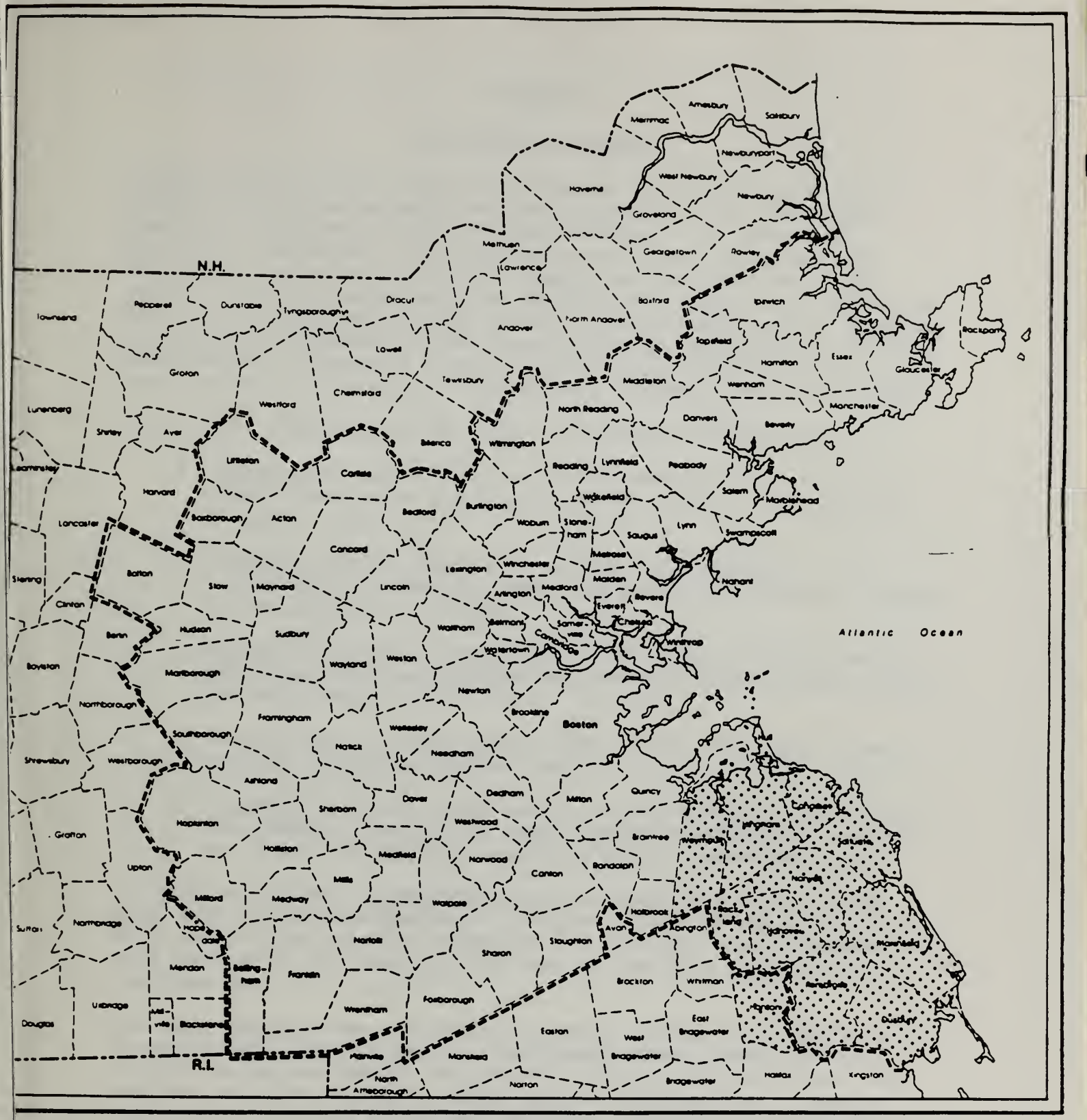


4 2 0 4 8 12

Scale in Miles

SOUTH SHORE
WATER SUPPLY PROTECTION
STUDY AREA

MAPC

Metropolitan Area
Planning Council

N

MAPC boundary

CHAPTER 1

BACKGROUND AND SUMMARY

In 1986, the South Shore Coalition formed the South Shore Water Supply Protection Committee to enable the twelve communities to coordinate planning and management of their water resources. The twelve town committee is comprised of the South Shore Coalition plus Hanson and Pembroke. First on the committee's agenda was the protection of the quality of drinking water resources in the twelve communities. In October 1986, Metropolitan Area Planning Council secured a water quality planning grant from the Department of Environmental Quality Engineering to assist the committee in preparing a regional water supply protection plan. This report presents the analysis, findings, and recommendations of the study.

The overall methodology of the study included the following steps:

- o inventory the water resources of the communities and identify areas of particular significance to the quantity and quality of the water supply;
- o inventory existing land uses and potential sources of contamination in the study area, and assess their potential threat to the quality of the water;
- o analyze the zoning of undeveloped land within the study area and determine the extent to which new permitted land uses could affect the water supply in the future;
- o identify and evaluate existing local, state, and federal water resource protection measures; and
- o recommend additional water supply protection measures to mitigate the potential land use and zoning impacts identified in the study and insure the long term quality of drinking water resources.

All the findings and recommendations were reviewed by the South Shore Water Supply Protection Committee, which met throughout the course of the study and provided valuable information and guidance. The recommendations were endorsed by the Committee, and later by the South Shore Coalition by unanimous vote.

The water supply systems in the twelve community study area supply water to approximately 200,000 people. Individually these communities meet current average day demands, but several fall short of peak summer needs and must buy water from other towns, use emergency sources, or impose water use restrictions during such shortages. Without wise management of the region's water resources this situation will only worsen as the service population increases.

Protection of the existing water supply sources is vitally important to the communities given that all drinking water comes from local sources and there are few practical alternative supply sources available to the communities. Several towns in the study area have experienced contamination and supply shortages. Out-of-region sources such as the Massachusetts Water Resources Authority cannot be considered as an alternative. The ability of these communities to remain self-sufficient in water supply may depend upon how the communities collectively manage existing and future development in their water supply aquifers and watersheds.

Land uses within the water supply area can affect both water quality and water quantity through physical alteration of the environment which changes drainage patterns and rates of runoff and recharge, and through discharge of contaminants to surface or groundwater. Developed land uses in the study area (not including Hanson) have increased in the last thirty years by 112%. Associated with developed land uses are a number of potential contamination sources. Most of this report centers on the identification of potential sources of contamination and measures which the communities can take to safeguard against loss of water supplies.

This report includes an investigation of the potential sources of contamination in the areas which overlay aquifers and in watershed areas for reservoirs and lakes utilized as municipal water supplies. This is the area referred to as the South Shore Water Study Area. The potential sources of contamination investigated include: underground storage tanks, wastewater, road salt, leachate, hazardous wastes, pesticides and mining. In addition, this study examines zoning and other local regulations in the study area and has identified areas requiring additional protection to insure the long term quality of the water resources.

Through an analysis of this information a set of recommendations was developed to augment and strengthen local policies and regulations to manage activities within the water supply areas. The major elements of these recommendations are:

1. The communities of the South Shore Coalition should form a standing Water Supply Protection Advisory Committee. The committee could be formed by the signing of a Memorandum of Understanding by the towns' selectmen and/or by the adoption of a model bylaw by town meeting in each community.

   The functions of such an advisory committee may include:

   - o to make recommendation relative to water supply protection measures which could be adopted by the towns under their independent home rule authority;

   - o to make recommendations relative to the adoption and promulgation of rules and regulations of several town boards;

- o to consult together as a mechanism for joint local action for the resolution of water quality and water resource issues, including actions necessary for compliance with recent amendments to the Safe Drinking Water Act.

2. In order to increase the level of production of the region's drinking water resources, the communities should consider adopting the following water resource protection measures:

   - o a requirement that septic systems be inspected, and pumped if necessary, at the time of sale or transfer of a property;

   - o a requirement that residential underground fuel tanks be tested for leaks at the time of sale or transfer of a property;

   - o a supplemental Board of Health regulation which establishes a maximum percolation rate of two inches per minute, and prohibits the use of dewatered percolation tests for septic system approvals.

Implementation of the recommended program will require the cooperation and support of several local boards on an intra- and intercommunity basis, as well as town meeting support for new or amended bylaws. An important element for successful implementation will be public education. The South Shore Water Study Committee may assist in these efforts, which may include public meetings and presentations, as well as development of brochures or other educational materials. Increasing public awareness of water supply protection will be as important as modifying local regulations in meeting the goals of the water supply protection program.

In the chapters that follow, background information, data analysis, and the recommended plan are presented in detail. Through the implementation of the study's proposed recommendations, the communities of Cohasset, Duxbury, Hanover, Hanson, Hingham, Hull, Marshfield, Norwell, Pembroke, Rockland, Scituate, and Weymouth may continue to move forward in the development of a comprehensive water supply protection program.

Chapter 2

WATER SUPPLY SYSTEM PROFILE

Prior to examining the protection needs of the South Shore's water resources, it is useful to have an overview of the elements and operation of the water supply systems. This will aid in formulating a protection plan which is responsive to the needs of the region.

WATER USE AND CONSUMPTION

Within the South Shore area water is supplied to approximately 200,000 people. Local water systems operate about 60 wells and 7 reservoirs.

Over the last seven years, average day demand has fluctuated between 18.67 and 19.36 mgd (see Table 2-1 and Figure 2-1). Maximum day demand for the region has fluctuated approximately between 34.5 and 37.5 mgd during the years 1983 through 1985 (see Table 2-2 and Figure 2-2).

Table 2-1
AVERAGE DAILY DEMAND (MGD)

	1980	1981	1982	1983	1984	1985	1986
COHASSET	0.74	0.78	0.78	0.79	0.71	0.59	0.57
DUXBURY	1.28	1.29	1.17	1.29	1.21	1.27	1.27
HANOVER	1.05	1.08	1.13	1.05	1.11	1.12	1.01
HANSON	0.58	0.55	0.51	0.53	0.57	0.59	0.63
HINGHAM/HULL	3.76	3.72	3.55	3.57	3.08	3.23	3.23
MARSHFIELD	2.81	2.88	2.76	2.74	3.18	3.31	3.04
NORWELL	0.89	0.89	0.88	0.89	1.03	1.27	1.42
PEMBROKE	0.88	0.85	0.90	1.05	1.05	1.09	1.29
ROCKLAND	0.99	0.98	0.94	0.97	0.99	1.35	1.41
SCITUATE	1.70	1.72	1.55	1.64	1.68	1.42	1.40
WEYMOUTH	4.47	4.06	4.50	4.67	4.46	3.89	4.09
TOTAL	19.15	18.80	18.67	19.19	19.07	19.13	19.36

Figure 2-1
AVERAGE DAILY DEMAND

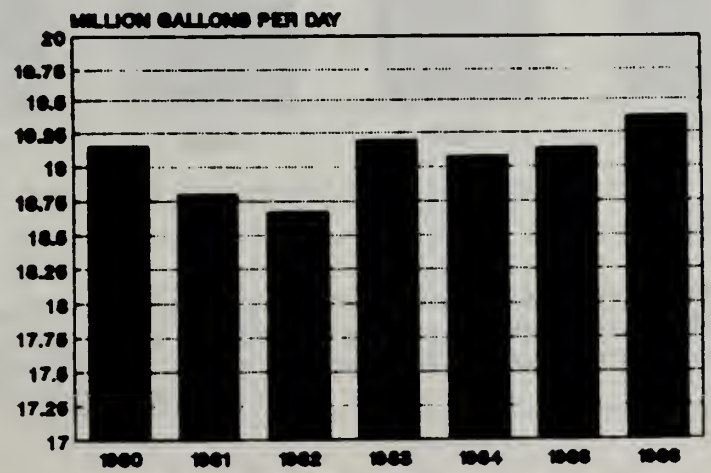
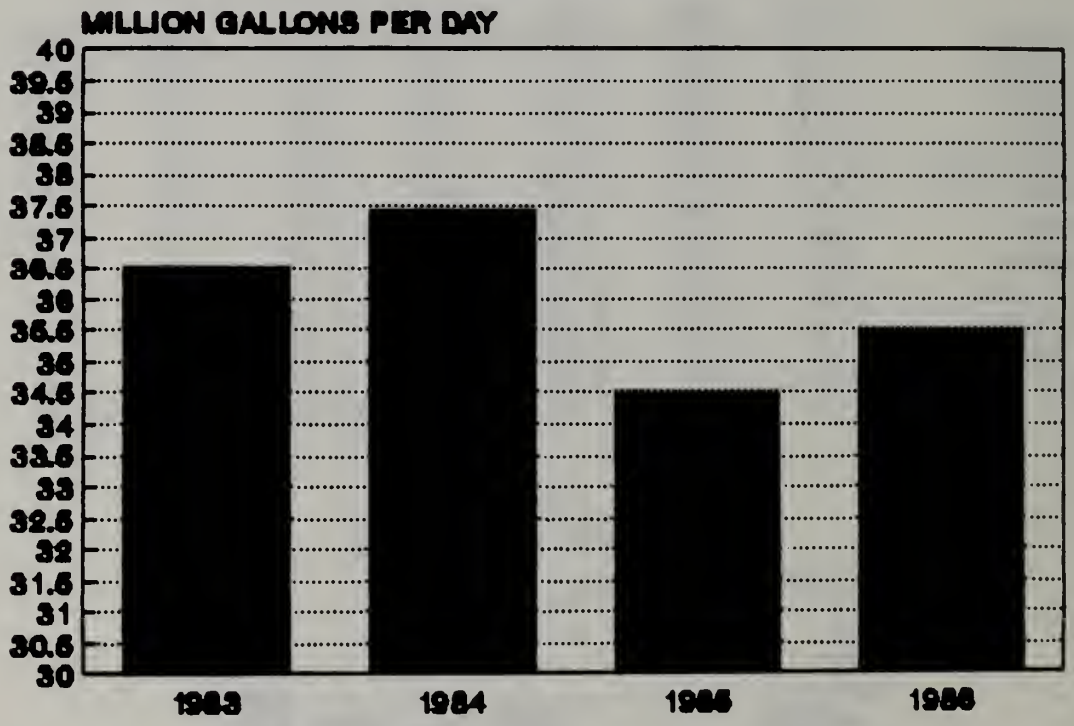


Table 2-2
MAXIMUM DAY DEMAND (MGD)

	1982	1983	1984	1985	1986	Yield
COHASSET	1.25	1.44	1.11	1.10	1.13	2.12
DUXBURY	3.10	3.09	2.66	2.50	3.03	5.03
HANOVER	1.88	1.93	1.89	2.11	1.91	3.41
HANSON	n/a	0.62	1.01	0.84	0.81	1.12
HINGHAM/HULL	6.04	6.68	7.03	5.84	5.37	6.80
MARSHFIELD	6.08	4.97	6.00	6.08	5.56	9.46
NORWELL	1.55	1.67	1.64	1.90	2.00	2.28
PEMBROKE	1.51	1.99	2.14	1.54	1.61	2.00
ROCKLAND	3.99	4.39	4.56	3.48	3.99	2.78
SCITUATE	2.90	3.02	3.01	2.76	2.57	5.18
WEYMOUTH	4.22	6.69	6.37	6.33	7.50	7.50
TOTAL	n/a	36.49	37.42	34.48	35.48	47.68

n/a = information not available

Figure 2-2
MAXIMUM DAY DEMAND



WATER SUPPLY SOURCES

The South Shore region relies on groundwater and surface water resources. A town by town list of sources of supply and their safe yields are found in Table 2-3. The combined safe yield of all towns is 47.7 mgd (Table 2-4).

Table 2-3
SOURCES OF SUPPLY - Yield (mgd)

SOURCES	GROUNDWATER	SURFACE WATER	TOTAL
COHASSET			
Ellms Meadow Well	.060	(for standby and peak demand)	
Sohier Street Wells	.060	(for standby emergency only)	
Lily Pond		2.00	
Total Safe Yield	0.120	2.00	2.120
DUXBURY			
Millbrook	.473		
Tremont #1	.576		
Tremont #2	.432		
Depot St.	.470		
Partridge Rd.	.346		
Evergreen #1	.864		
Evergreen #2	.648		
Lake Shore	.504		
Mayflower East	.720		
Total Safe Yield	5.033	0	5.033
HANOVER			
Pond St. #1	.576		
Pond St. #2	.864		
Pond St. #3	.864		
Broadway #1	.288		
Broadway #2	.310		
Hanover St. #1	.259		
Hanover St. #2	.245		
Total Safe Yield	3.406	0	3.406
HANSON			
Crystal Spring	.504		
Crystal Spring Wellfield	.576		
Approximate Purchase from Brockton		0.044	
Total Safe Yield	1.080	0.044	1.124
HINGHAM/HULL			
Scotland St.	1.000		
Prospect St.	0.500		
Downing St.	0.500		
Free St. #2	2.000		
Free St. #3	0.300		
Accord Pond		2.500	
Total Safe Yield	4.300	2.500	6.800

SOURCES	GROUNDWATER	SURFACE WATER	TOTAL
MARSHFIELD			
Furnace Brook #1	1.008		
Furnace Brook #2	.576		
Furnace Brook #3	.432		
Furnace Brook #4	1.440		
South River St.	.504		
School St.	.432		
Webster #1	.576		
Webster #2	.324		
Ferry St.	.576		
Church St.	.828		
Mt. Skirgo	.432		
Parsonage #1	.396		
Union St. #1	1.440		
Union St. #2	.504		
Total Safe Yield	9.468	0	9.468
NORWELL			
South St. #1	.336		
South St. #6	.336		
Grove St. #2	.230		
Grove St. #3	.173		
Grove St. #5	.288		
Ridge Hill Rd. #4	.302		
Washington St. #7	.192		
Washington St. #8	.139		
Bowker St. #9	.288		
Total Safe Yield	2.284	0	2.284
PEMBROKE			
Well #1	.500		
Well #2	1.000		
Well #3	.500		
Total Safe Yield	2.000	0	2.000
ROCKLAND			
Myers Ave Wellfield	0.578		
Great Sandy Bottom Pond		1.360	
Hingham St. Reservoir		.848	
Total Safe Yield	0.578	2.208	2.786
SCITUATE			
Well #10	0.380		
Well #11	0.380		
Well #17	0.500		
Well #22	0.500		
Well #18A	0.300		
Well #19	0.500		
Aaron R. Reservoir		3.00	
Total Safe Yield	2.18	3.00	5.180

SOURCES	GROUNDWATER	SURFACE WATER	TOTAL
WEYMOUTH			
Whitman's Pond Well			
Mill River Valley Wells	2.800		
Great Pond		2.100	
Whitman's Pond		2.600	
Total Safe Yield	2.800	4.700	7.5

Table 2-4
SOUTH SHORE REGIONAL TOTALS
Safe Yield (mgd)

TOWN	TOTAL
Cohasset	2.120
Duxbury	5.033
Hanover	3.406
Hanson	1.124
Hingham/Hull	6.800
Marshfield	9.468
Norwell	2.284
Pembroke	2.000
Rockland	2.786
Scituate	5.180
Weymouth	7.500
TOTAL	47.701

EMERGENCY SOURCES

The available emergency sources are very limited. The South Shore communities rely mainly on standby wells or connections with nearby towns during emergency situations (Figure 2-3).

Figure 2-3
EMERGENCY SOURCES

Cohasset	Sohier St. wells are for standby emergency, .12 mgd yield.
Duxbury	There are emergency connections with Kingston, Pembroke and Marshfield.
Rockland	Foxes Pit wells will open for emergency use only.
Pembroke	There are emergency connections with Brockton, Kingston, Duxbury and Hanover.
Hanson	There are emergency connections with Brockton, Whitman, East Bridgewater, Halifax, Hanover, and Abington/Rockland.
Scituate	There is an emergency connection with Cohasset in North Scituate. A future connection with Marshfield is included in the State's reconstruction plan of the Route 3A North River Bridge.
Marshfield	Parsonage well no.1 is for emergency use, .40 mgd yield.
Norwell	none
Hingham/Hull	none
Weymouth	none
Hanover	n/a

POTENTIAL FUTURE SOURCES

Several towns have well developed future plans while others are exploring the possibility, or need to, (see Figure 2-4).

Figure 2-4
POTENTIAL FUTURE SOURCES

COHASSET	unknown at this time
DUXBURY	9 prospective wells (4 off Church Street, 1 off Island Creek Road, 2 off Mayflower, 2 off Teakettle Lane)
HANOVER	n/a
HANSON	currently exploring for more groundwater
HINGHAM/HULL	Free Street Station
MARSHFIELD	4 prospective well sites (2 are north of Ferry St. and west of Church Street, 1 off Pioneer Trail and 1 located east of route 3A, north of the fairgrounds
NORWELL	currently developing well off Grove Street
PEMBROKE	n/a
ROCKLAND	currently working on EIR for Hingham Street Reservoir Expansion
SCITUATE	Dolan Well Site and a long range plan for expanding the reservoir.
WEYMOUTH	none

WATER QUALITY

With the exception of sodium levels, all towns deliver water which meets the state's requirements under the Safe Drinking Water Act. However, many towns have had some form of contamination reaching their water sources. Norwell and Weymouth have high sodium levels, Hanson and Scituate have trace chemicals, and Marshfield has closed several wells due to volatile organics. An overview is found in Figure 2-5. A more in-depth water quality analysis from the Department of Water Quality Engineering (DEQE) is listed in Appendix B, 1-8.

Figure 2-5
WATER QUALITY PROBLEMS

COHASSET	Underground fuel tank leakage into Lily Pond Reservoir
DUXBURY	Iron in both Evergreen Wells
HANOVER	n/a
HANSON	Very small amounts of violates found in Crystal Spring Well
HINGHAM/HULL	Manganese
MARSHFIELD	Furnace #1 - PCE, Furnace #2 - PCE, Furnace #3 - Benzene, Furnace #4 - Tolulene, South River Street - TCE, School Street - PCE, and Mt. Skirgo - PCE
NORWELL	4 wells have high sodium levels
PEMBROKE	no problems
ROCKLAND	Foxes Pit was shutdown due to discoloration from iron and manganese
SCITUATE	Corrosive groundwater, surface water taste and odor from algae, one well closed from excessive hardness from unknown source. One well has low levels of TCE (Well No. 19).
WEYMOUTH	High sodium levels

WATER TREATMENT

Most of the region's water is treated. Chlorine and fluorine treatment is common throughout the study region. Several towns have filtration systems and use corrosion controls (see Figure 2-6).

Figure 2-6
WATER TREATMENT

COHASSET	W.T.P. - filtration, flocculation, sedimentation, chlorination.
DUXBURY	hexametaphosphate and fluoride - all wells
HANOVER	polymer, chlorine, aluminum sulfate, sodium hydroxide, and hydrated line
HANSON	corrosion control - potassium hydroxide
HINGHAM/HULL	disinfection and fluoridation - all wells hexametaphosphate all wells except Fulling Mill, Scotland St-corrosion control, Free St. #2 - greensand filter, Free St. #3.4 corrosion control, Fulling Mill corrosion control and celite filter
MARSHFIELD	Union Street No. 1 is presently treated with lime. All wells are expected to have lime treatment by 1988. Furnace Brook No. 1 is being treated temporarily with carbon filtration and chlorination.
NORWELL	None
PEMBROKE	Well #1 verodox for iron, soda ash for pH and fluoride Well #2 and #3 soda for pH and fluoride
ROCKLAND	Great Sandy Bottom Pond - prechlorination, chlorine and metaphosphate Hingham St. W.T.P. prechlorination, coagulation, sedimentation, filtration, sodium hydroxide, chlorine, potassium permanganate Myers St., prechlorination, filtration, sodium hydroxide, chlorine, potassium, permanganate
SCITUATE	Surface Water Supply - coagulation, flocculation, sedimentation, rapid carbon filtration, and chlorination. Groundwater Supply - fluoridation with sodium fluoride
WEYMOUTH	Great Pond W.T.P. - chlorination, fluoridation Winter Street W.T.P. - chlorination, fluoridation Whitman's Pond Well - corrosion control and disinfection

Chapter 3

WATER RESOURCES AND ENVIRONMENTALLY SENSITIVE AREAS

This chapter describes the characteristics of the natural environment within the South Shore region and their significance to the public water supplies. The areas addressed are geology, groundwater resources, soils, wetlands, and watershed areas.

GEOLOGY

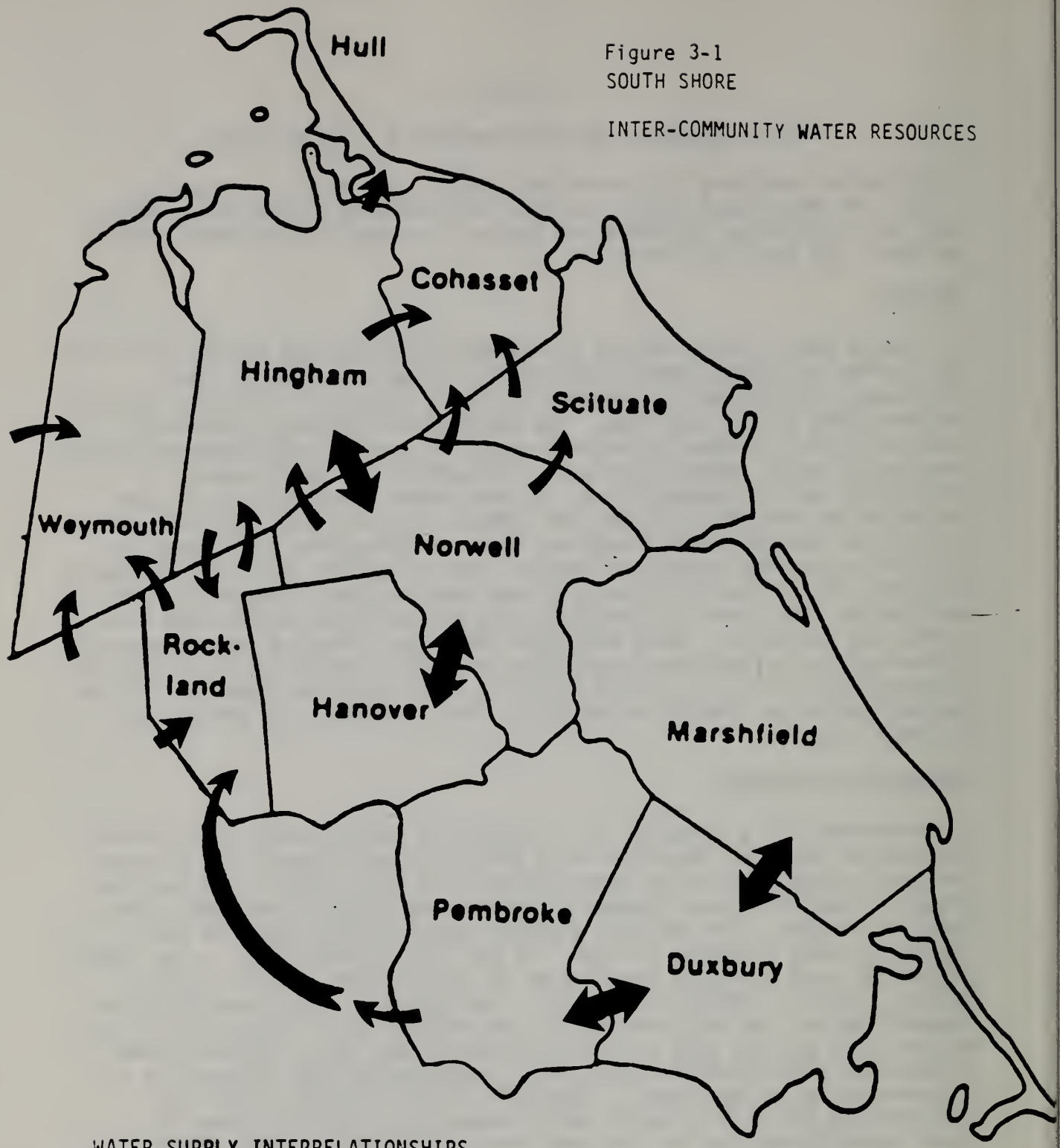
The region has a gently rolling topography and a drainage pattern consisting of a series of wetland areas connected by streams and rivers. The topography is the result of changes caused by a glacier during the last ice age more than 10,000 years ago. The South Shore's geology consists of bedrock which is covered by varying depths of unconsolidated materials which were deposited by ice age glaciers. The bedrock includes igneous, metamorphic and sedimentary rock. In most areas the bedrock is 10 feet below the surface, but outcrops are common. The surficial materials can be classified into two major groupings, till and stratified drift deposits. Till is an unsorted mixture of various sizes of grains, from clay to sand to boulders. Stratified drift deposits are sand and gravel deposits which are well sorted into layers of somewhat uniform grain size, making them both porous and permeable. These qualities make them favorable for storage and transmission of significant quantities of water. Stratified drift deposits are frequently found as "buried valleys", where meltwater deposits fill in depressions in the underlying bedrock. This represents the pre-glacial drainage pattern.

GROUNDWATER RESOURCES

The occurrence of groundwater in the region is controlled by the surficial and bedrock geology. Aquifers which yield sufficient quantities of water for public supply wells are generally found in thick deposits of sand and gravel. These areas are capable of storing and transmitting significant amounts of water. The thickest areas of such permeable deposits are generally found in buried valleys. Of the twelve communities in the study area, five rely solely on groundwater for their drinking water supply, Duxbury, Hanover, Marshfield, Norwell, and Pembroke. The remaining seven communities rely on both groundwater and surface water. The areas of focu of the study are six high potential yield aquifers which intersect town boundaries, approximately 3200 acres. These aquifers are referred to as intercommunity aquifer areas. Figure 3-1 is a map of the study area illustrating the intercommunity water resources. Table 3-1 shows the intercommunity aquifers in the study area and their acreages. Table 3-3 gives a summary of intercommunity resources for the entire study area, which includes aquifers and watersheds.

Figure 3-1
SOUTH SHORE

INTER-COMMUNITY WATER RESOURCES



WATER SUPPLY INTERRELATIONSHIPS

WATERSHED AREAS CONTRIBUTING SURFACE WATER TO RESERVOIRS IN OTHER TOWNS

AQUIFERS WHICH SUPPLY GROUNDWATER TO TWO TOWNS

TOWNS SUPPLIED BY JOINT WATER SUPPLY SYSTEMS

Table 3-1
INTERCOMMUNITY AQUIFER AREAS (acres)

AQUIFERS	DUXB	HANO	HANS	HING	MARS	NORW	PEMB	ROCK	TOTAL
DUXBURY/MARSHFIELD	507				714				1221
DUXBURY/PEMBROKE	62						125		187
HANOVER/NORWELL		142				119			261
HANOVER/ROCKLAND		34						84	118
HANSON/PEMBROKE			191				1169		1360
HINGHAM/NORWELL				215		166			381
TOTAL	569	176	191	215	714	285	1294	84	3528

SOILS

The soils of the region have formed in materials influenced by glaciation. The region's upland hills and ridges are covered with loamy or sandy glacial till. Stones and boulders are normal surface features. Bedrock outcrops are common. The soils in this area are varied, but all have a substrata of sand or sand and gravel. There are four general soil associations found in the study area, Paxton-Hollis-Canton, Scituate-Essex-Ridgebury, Hinkley-Windsor-Muck, and Dune Land-Tidal Marsh-Beach.

Paxton-Hollis-Canton is dense firm glacial till. It is fine sandy loam found on hills and ridges. These soils are well drained and are free from problems associated with wetness.

Scituate-Essex-Ridgebury is also dense firm glacial till. These are found on level ground or moderate hills and ridges. The soils are sandy loam over a sandy substrata. The surface has many stones with a slowly permeable substrata.

Hinkley-Windsor-Muck is formed dominantly by water sorted glacial outwash. They are generally found in valleys or level to rolling terraces, kames, deltas and eskers. This soil is often suited to agriculture. Many of these soils are free of water table problems and may be limited by aridity.

Dune Land-tidal Marsh-Beach are areas of wind deposited sand, ocean washed beach and tidal flooded marshes.

WETLANDS

Wetlands are low lying, transitional areas between terrestrial and aquatic systems where the water table is usually at or near the surface or, the land is covered by shallow water. Wetland areas have several unique functions and values with respect to water supplies, they filter pollutants entering streams, provide temporary storage for flood control, supply base

flows for streams and rivers, and supply water to the surface system in periods of limited rainfall. In Massachusetts, wetlands are delineated by the presence of wetlands vegetation under the State Wetlands Protection Act.
According to 1984 MacConnell land use data about 8,700 acres or 8 percent of the region (excluding Hanson) is wetlands (land use data is available in chapter 4).

WATERSHED AREAS

The South Shore region includes 3 drainage basins, the Weymouth and Weir River basin, the North and South River basin, and the South Coastal Shore basin. There are several subbasins or watersheds found in each of these larger basins. This study focuses on seven watersheds covering approximately 5,000 acres. These watersheds are referred to as the Aaron River, Accord Pond, Hingham Street Reservoir, Lily Pond, Great Sandy Bottom Pond, Tack Factory Pond/First Herring Brook, and Whitman/Great Pond watersheds. These particular watersheds all intersect town borders, therefore are considered to be intercommunity water resources. These subbasins and acreages are listed in Table 3-2. Figure 3-2 and Table 3-3 describes the location of five intercommunity watershed areas and illustrates the acreages and percentages of the watershed area which falls inside and outside of the user community's boundary. Table 3-4 lists the towns in the intercommunity study area with water supply watersheds within its borders and the acreages and percentages the watershed area represents within each community. Figure 3-3 further illustrates by pie chart the towns listed in Table 3-4. Table 3-5 summarizes the acreage data for the entire intercommunity study area, (watersheds and aquifers) and illustrates what percent of each town these areas represent. Because the towns Cohasset, Hull, and Weymouth do not overlay any other community's water supply source they have been omitted from Table 3-5.

Table 3-2
INTERCOMMUNITY WATERSHED AREAS (acres)

WATERSHEDS (location)	COHA	HANS	HING	NORW	PEMB	ROCK	SCIT	WEYM	TOTAL
AARON RIVER\ LILY POND (Cohasset)	2339		1130	2008			415		5,892
ACCORD POND (Hingham)			305	232		76			613
GREAT SANDY BOTTOM POND (Pembroke/Hanson)		334			2125				2,459
HINGHAM STREET (Rockland)			23			416			439
TACK FACTORY POND (Scituate)				450			2866		3,316
WHITMAN/GREAT POND (Weymouth)			412			390		5450	6,252
TOTAL	2339	334	1870	2690	2125	882	3281	5450	18,971

Figure 3-2

SOUTH SHORE SURFACE WATER SUPPLIES:
LOCATION OF RESERVOIR WATERSHED LANDS

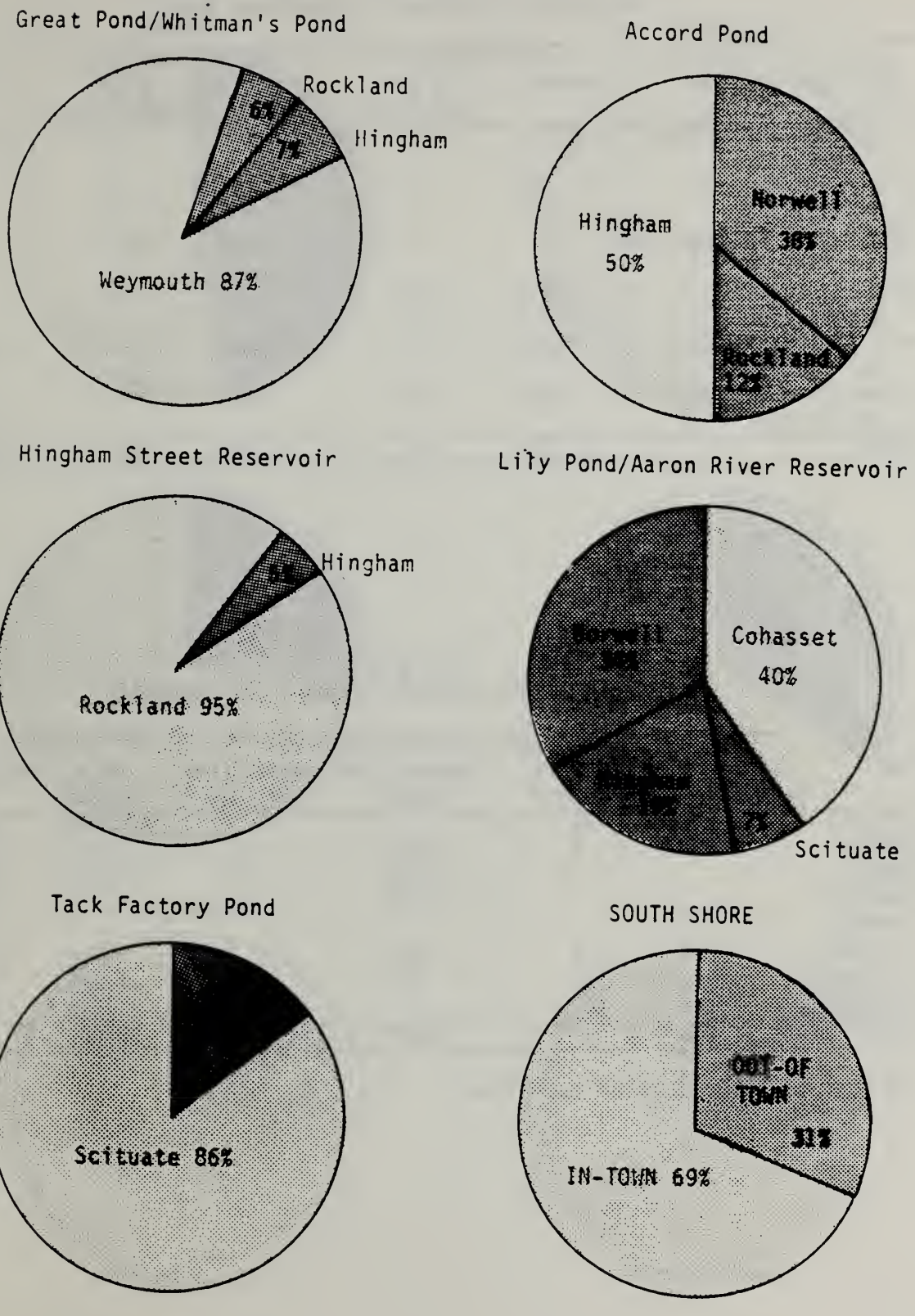


Table 3-3
SOUTH SHORE INTERCOMMUNITY WATER RESOURCES
Location of Reservoir Watershed Areas

RESERVOIRS/USER	IN TOWN AREA Acres	IN TOWN AREA % of Watershed	OUT OF TOWN AREA Acres	OUT OF TOWN AREA % of Watershed	TOTAL
Aaron River\Lily Pond (Cohasset)	2,339	40	3,553	60	5,892
Accord Pond (Hingham)	305	50	308	50	613
Great Sandy Bottom Pond (Rockland)		0	2,459	100	2,459
Hingham Street (Rockland)	416	95	23	5	439
Tack Factory Pond (Scituate)	2,866	86	450	14	3,316
Whitman/Great Pond (Weymouth)	5,450	87	802	13	6,252
TOTAL	11,376	69	7,595	31	18,971

Table 3-4
INTERCOMMUNITY WATERSHED AREAS - BY COMMUNITY

TOWN	WATERSHED AREAS WHICH DRAIN TO: In-Town Reservoirs Acres	In-Town Reservoirs Percent*	Out-of-Town Reservoirs Acres	Out-of-Town Reservoirs Percent*	TOTAL Acres	PERCENT*
COHASSET	2,339	36			2,339	36
HINGHAM	305	2	1,565	11	1,870	13
NORWELL			2,690	19	2,690	19
PEMBROKE/ HANSON			2,459	10	2,459	10
ROCKLAND	416	6	466	7	882	14
SCITUATE	2,866	25	415	4	3,281	29
WEYMOUTH	5,450	47			5,450	47
TOTAL	11,376		7,595		18,971	

*Percent of total area of each town

Figure 3-3

PERCENTAGE OF LAND AREA IN RESERVOIR WATERSHEDS

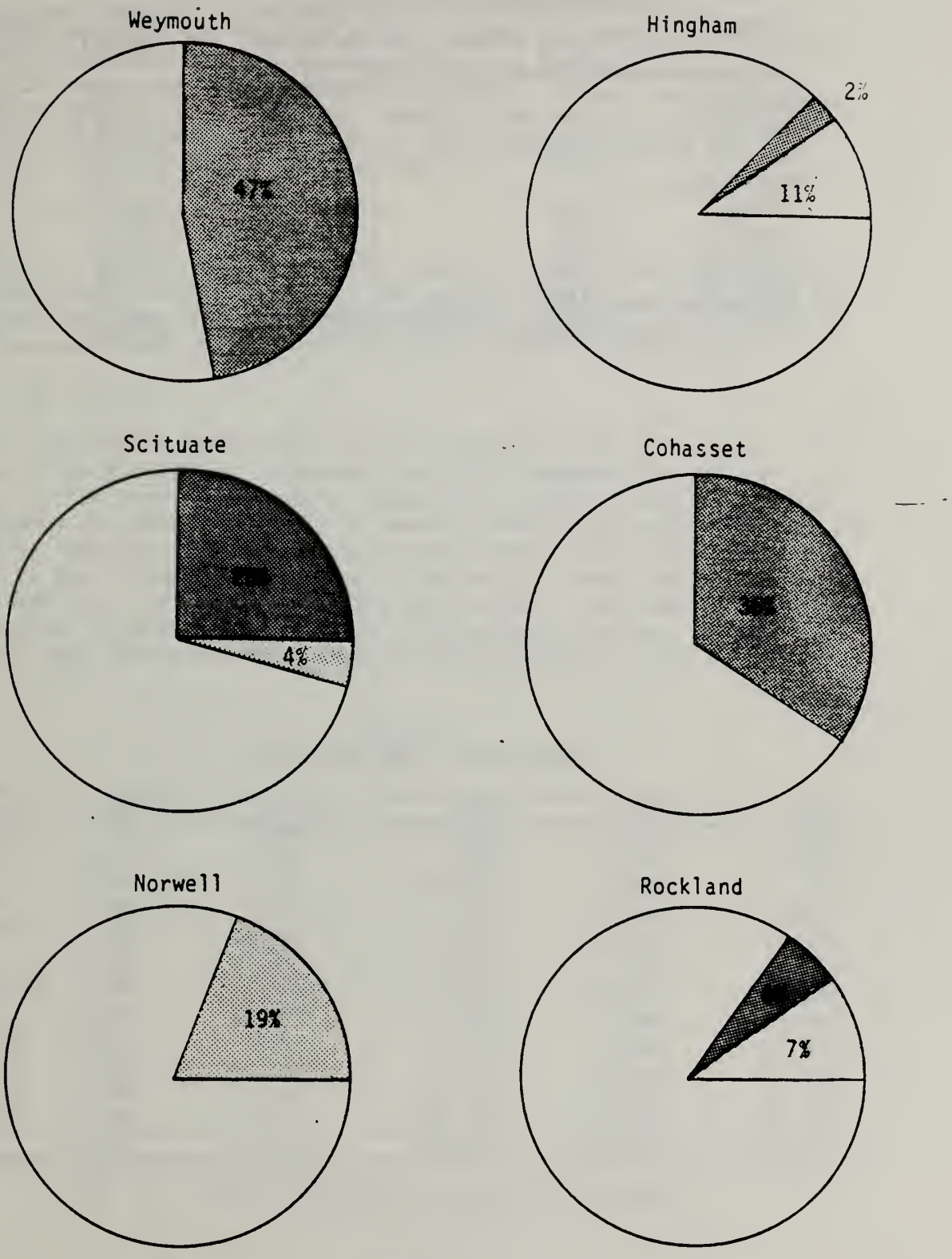


Table 3-5

OUT OF TOWN ACREAGES OF INTERCOMMUNITY WATER RESOURCE AREAS--SUMMARY

COMMUNITY	Intercommunity Watershed Areas (acres)	Intercommunity Aquifer Areas (acres)	TOTAL (acres)	PERCENT of town (%)
DUXBURY		569	569	4
HANOVER		166	166	2
HANSON	334	191	525	?
HINGHAM	1,565	215	1,780	12
MARSHFIELD		714	714	4
NORWELL	2,690	285	2,975	23
PEMBROKE	2,125	1,294	3,419	8
ROCKLAND	466	84	550	10
SCITUATE	415		415	4
TOTAL	7,595	3,518	11,113	8

Chapter 4

LAND USE AND AND WATER SUPPLY IMPACTS

This section describes the uses of land in the South Shore region, and examines the potential impacts of the land use on the quantity and quality of water supply sources in the region. After a brief review of the recent growth and development trends of the region, water supply impacts will be addressed in terms of the potential sources of contamination associated with land use.

HISTORIC DEVELOPEMENT TRENDS

This section reviews the last three decades of growth and developement in the South shore study area. This perspective aids in understanding the existing land uses, as it provides information on past activities which today may affect the water supply sources. Table 4-1 gives the

POPULATION TRENDS

Table 4-1 gives the population for each town over the last three decades. The population increased steadily throughout the earlier years. In the most recent years, growth has slowed. According to the U.S. Census estimates for 1986, in several towns (Rockland, Scituate, and Weymouth), the population has actually decreased. The stabilization of growth is more clearly illustrated in Table 4-2, where the regional totals and their percent changes are calculated. From 1950 to 1960, a 59% increase in population occurred. In contrast, between the years of 1980 and 1986 there was very little population growth, a 1% change.

Table 4-1
POPULATION DATA, 1950-1986

TOWNS	1950	1960	1970	1980	1986
COHASSET	3,731	5,840	6,950	7,174	7,290
DUXBURY	3,167	4,727	7,636	11,807	13,820
HANOVER	3,389	5,923	10,107	11,358	11,560
HANSON	3,264	4,370	7,148	8,617	9,010
HINGHAM	10,665	15,378	18,845	20,339	19,670
HULL	3,379	7,055	9,961	9,714	9,630
MARSHFIELD	3,267	6,748	15,223	20,916	22,180
NORWELL	2,515	5,207	7,796	9,182	9,240
PEMBROKE	2,579	4,919	11,193	13,487	14,540
ROCKLAND	8,960	13,119	15,674	15,695	15,340
SCITUATE	5,993	11,214	16,473	17,317	16,960
WEYMOUTH	32,690	48,177	54,610	55,601	54,480
TOTAL	83,599	132,677	181,616	201,207	203,720

sources: 1950-1980: U.S. Census
1986: U.S. Census, community population estimate

Table 4-2
REGION POPULATION AND PERCENT CHANGES, 1950-1986

YEAR	POPULATION	%CHANGE
1950	83,599	--
1960	132,677	59
1970	181,616	37
1980	201,207	11
1986	203,702	1

source: U.S. Census

LAND USE TRENDS

The population growth is also reflected in the changing land uses in the region over the last 30 years. The following data on historic land use was taken from a study by William MacConnell of the University of Massachusetts, who has classified and mapped land uses by interpretation of aerial photography. The minimum parcel size mapped was three acres. Data does not include Hanson. Table 4-3 shows a breakdown of land use for 1951 and 1984, change in acreage, and percent change. Residential lands gained approximately 15,000 acres while forest lands lost 12,000 acres. Commercial and Transportation land uses showed the highest percentage increases 305% and 423%, respectively.

Table 4-3
LAND USE CHANGE (acres), 1951-1984

LAND USE	1950	1984	CHANGE	%CHANGE
Residential	16,784	31,709	14,925	89
Industrial	569	839	270	47
Commercial	440	1,784	1,344	305
Transportation	257	1,346	1,089	423
Mining	*	1,001	1,001	*
Waste Disposal	*	154	154	*
Open & Public	1,392	2,305	913	66
Recreation	*	2,165	2,165	*
Total Developed Land	19,442	41,303	21,861	-112
Forest	63,209	50,937	-12,272	-19
Wetlands	9,712	8,755	-882	-9
Water	1,345	2,927	1,582	118
Agriculture	12,064	3,269	-8,795	73
Open	3,352	1,933	-1,419	42
Total Undeveloped Land	89,682	67,821	-21,861	-24
Total	109,124	109,124	---	---

* Mining, Waste Disposal, and Recreation were not included in the 1951 survey

SUMMARY OF EXISTING LAND USE

Table 4-4 shows the acreage of each land use category in 1984 for each town in the study area (except Hanson). Table 4-5 gives land use totals and percentages for 1984 for the entire region. Of note, 38% of the region was developed, while 62% was undeveloped in 1984.

Table 4-4
1984 LAND USE (acres)

LAND USE	COHA	DUXB	HANO	HING	HULL	MARS	NORW	ROCK	SCIT	WEYM	TOTALS
RESIDENTIAL	1,772	2,244	2,658	3,911	1,014	4,799	2,844	1,671	3,797	4,999	31,709
INDUSTRIAL	15	10	120	293	15	25	41	145	40	135	839
COMMERCIAL	123	41	308	208	55	199	175	143	119	413	1,784
TRANSPORTATION	---	229	65	89	20	80	180	225	10	448	1,346
MINING	---	56	101	183	---	256	56	65	94	190	1,001
WASTE DISPOSAL	---	30	14	---	5	20	---	50	10	25	154
OPEN & PUBLIC	139	111	207	657	88	191	108	148	217	439	2,305
RECREATION	170	496	108	247	138	340	39	95	345	187	2,165
TOTAL DEVELOPED LAND	2,219	5,217	3,581	5,588	1,335	5,910	3,443	2,542	4,632	6,836	41,303
FOREST	3,450	6,750	5,550	7,500	235	8,675	8,091	3,050	4,033	3,603	50,937
WETLANDS	439	1,700	195	474	94	2,680	671	294	1,888	320	8,755
WATER	213	534	96	314	5	565	219	75	281	625	2,927
AGRICULTURE	29	924	371	493	15	663	393	125	238	18	3,269
OPEN	62	329	185	132	54	185	316	335	209	126	1,933
TOTAL DEVELOPED LAND	41,193	10,237	6,397	8,913	403	12,768	9,690	3,879	6,649	4,692	67,821
TOTAL	6,412	15,454	9,978	14,501	1,738	18,678	13,133	6,421	11,281	11,528	109,124

Note: Land Use is based on air photo interpretation; data has not been field verified.

Table 4-5
LAND USE TOTALS (acres), 1984

LAND USE	TOTALS	PERCENT
Residential	31,709	29.0
Industrial	839	.7
Commercial	1,784	1.6
Transportation	1,346	1.2
Mining	1,001	.9
Waste disposal	154	.1
Open and Public	2,305	2.0
Recreation	2,165	2.0
Developed Land	41,303	38.0
Forest	50,937	47.0
Wetlands	8,755	8.0
Water	2,927	2.7
Agriculture	3,269	3.0
Open	1,933	1.8
Undeveloped Land	67,821	62.0
Total	109,124	100.0

LAND USE/WATER SUPPLY IMPACTS

Land uses within the water supply study area can affect both water quality and water quantity through physical alteration of the environment. These alterations may change drainage patterns and rates of runoff and recharge, or through discharge of contaminants associated with each. For each of these potential sources of contamination, the analysis presents:

- o the characteristics and water supply impacts;
- o the land uses associated with each; and
- o existing conditions in the communities describing the prevalence of these land uses within the water supply study area.

The potential sources of contamination addressed are: underground fuel storage tanks, wastewater, road salt, leachate, hazardous wastes, pesticides, and mineral extraction.

POTENTIAL SOURCES OF CONTAMINATION

1. Underground Storage Tanks

   a. Potential Impacts. Leakage from tanks or piping which are subject to corrosion or puncturing can lead to contamination of water resources. Underground storage tank leaks are caused by a number of factors including defects in tank materials, improper installation, corrosive soils, problems with piping systems, weather conditions, or tank fatigue. Unprotected steel tanks have an average life expectancy of 15 years in corrosive soils. Such soils are common in Massachusetts. If tanks leak, gasoline can move through the ground and contaminate groundwater. A relatively small amount of fuel can contaminate large volumes of water since concentrations as low as several parts per billion in drinking water are considered unsafe.

   b. Related Land Uses. Fuel storage is typically associated with service stations, fuel companies, auto dealerships, public facilities, bus and truck fleets, schools, churches and other institutions and residences where large underground tanks are installed for additional storage.

   c. Existing conditions. Most of the communities in the study area maintain some records of underground storage tanks. These records are the registration forms required for gasoline and diesel tanks under state and federal regulations, and oil burner permits issued by the fire departments in each community. However, these records are often neglected and not kept up to date.

      Underground fuel licensing data for eight communities in the study area (Cohasset, Hanover, Hingham, Marshfield, Norwell, Pembroke, Rockland, and Scituate) were studied in detail (see Appendix A, 1-13). Within these towns there are over 200 facilities (auto sales, gas stations, etc.) storing fuel. Among these commercial facilities there are approximately 457 tanks currently licensed for the underground storage of fuel. Of these 457 tanks, 317 are more than 15 years old (see Table 4-6).

Table 4-6
SUMMARY OF UNDERGROUND FUEL LICENSES

AGE OF PERMIT	QUANTITY OF FUEL (GALLONS) 0-6,000	6,001-12,000	12,001 & over	unknown	total
0-5	29	10	5	1	45
6-10	23	10	2	1	36
11-15	38	13	6	2	59
16-20	86	12	12	2	112
21 and Over	118	28	11	4	161
Unknown	11	20	7	6	44
Total	305	93	43	16	457

2. Wastewater

a. Potential Impacts. Both surface water and groundwater supplies can be affected by problems associated with disposal of sanitary wastes. Failing septic systems can be caused by improper siting, installation or maintenance. Also soil type, depth to bedrock and depth to the water table can be major factors in septic system failure. Such failures can introduce excessive nutrients, chlorides, bacteria, and household chemicals into soil that can leach into water supplies. According to the Department of Environmental Quality Engineering (DEQE), septic systems on lots of less than 40,000 square feet in area have the potential to contaminate groundwater.

b. Related Land Uses. Residential, commercial, and industrial land uses generate wastewater.

c. Existing Conditions. All South Shore communities are unsewered within the intercommunity water study areas except for the town of Weymouth, which is completely sewered. Several of the coastal towns are sewered outside the water study area near to coastal waters. Therefore, the water supply area relies solely on septic systems to treat sanitary wastes. Consequently, the regions major concern will be the proper installation, operation, and maintenance of these systems.

3. Road Salt

a. Potential Impacts. Deicing chemicals such as sodium chloride applied to roads in winter or stored in uncovered piles can wash off pavement into surface water bodies or percolate through soils to groundwaters. Since standard water treatment systems are unable to remove sodium from drinking water, sodium concentrations that could be harmful to the health of some individuals may result. Also, at high concentrations, sodium can corrode water distribution pipes and water fixtures. Therefore, the DEQE has

set a health standard of 20 mg/l for sodium. DEQE requires regular sampling of sodium concentrations in public water supplies and notification of customers if the concentrations exceed the standard.

b. Related Land Uses. Land uses that are associated with application of road salt are transportation, for maintaining road safety in the winter, and residential, institutional, commercial, and industrial, for clearing parking lots and private drives. The Commonwealth of Massachusetts routinely treats state routes with 100% salt applied at a rate of 300 pounds per lane mile.

c. Existing Conditions. There are approximately 75 miles of state salted roads in the South Shore region; approximately 15 miles of these roads are located in the intercommunity water supply areas. Individual communities use varying salt to sand ratios. Several communities have salt stockpiles located within the water supply areas (table 4-6). There are several salt restricted areas in the region located in the vicinity of drinking water supplies.

Leachate

a. Potential Impacts. Leachate is liquid waste that results when water percolates through buried materials in sanitary landfills, waste impoundments, and other disposal sites. Depending on the characteristics of the buried materials, leachate can contain inorganic and organic contaminants, as well as dissolved solids that can degrade the quality of water supplies.

b. Related Land Uses. Land uses which may be associated with leachate generation are classified as waste disposal, industrial, and commercial. Waste uses include sanitary landfills and other official dump sites.

c. Existing Conditions. Cohasset has an active private landfill located on Crocker Lane. The landfill has recently filed for expansion. MEPA has requested that an EIR be prepared on the proposed expansion. The controversy includes the fact that the expansion area is located on the edge of the watershed which drains into Lily Pond. Currently, the decision is pending. Scituate has an active municipal landfill (without liner) on Driftway and two inactive landfills on Stockbridge Road. These are located within the Tack Factory Pond Reservoir Watershed. Also, there is an inactive landfill on Thos. Clapp Road located within the Aaron River Reservoir Watershed. The town of Pembroke has an active landfill on Hobomock St. which is located within a high potential yield aquifer with municipal wells (table 4-6).

Table 4-7
POTENTIAL SOURCES OF CONTAMINATION--SUMMARY

	Landfills Open	Landfills Closed	Salt Sheds	Auto Dumps	Surface Waste Impoundment
Cohasset	2		1		
Duxbury		2	1	1	
Hanover		2	1		2 (1)
Hanson		1			1
Hingham	1	1			2 (1)
Hull	1				1
Marshfield	2	2	1	1	1
Norwell		3	1		
Pembroke	1 (1)*	1 (1)*		2 (1)*	
Rockland	1	1	1	2 (1)*	2 (1)*
Scituate	1 (1)*	2 (2)*			1 (1)*
Weymouth		3 (1)*	1		3 (1)*
TOTAL	9 (2)	18 (4)	7	6 (2)	13 (5)*

( )* = in intercommunity watershed or aquifer areas
source: DEQE, Water Supply Protection Atlas\Waste Sources

5. Hazardous Wastes and Materials.

a. Potential Impacts. Hazardous wastes are wastes which are toxic, reactive, corrosive or ignitable. Improper handling of hazardous wastes is a threat to drinking water. However, federal and state regulations have been enacted to reduce the threat of contamination. A less obvious source of hazardous wastes is commonly referred to as "household hazardous wastes". These include materials such as bleach, mothballs, paint remover, oven cleaner, wood preservative, antifreeze, and used motor oil. If improperly disposed of, these substances can reach groundwater or surface water and result in contamination of water supplies. Because the South Shore study region is predominantly unsewered, it is especially sensitive to contamination. Properly operating septic systems can treat domestic sanitary wastes, but many "household hazardous wastes" disposed of in septic systems may travel unabated through the soil and enter groundwater or eventually travel to surface waters.

b. Related Land Uses. All developed land use types have the potential to be associated with hazardous wastes. Commercial and industrial uses pose a greater threat in terms of quantity but the handling of these materials is increasingly regulated by state and federal programs. Residential uses may also generate small quantities of hazardous wastes. Due to the high number of septic systems in use in the water study area, the concern is for the household hazardous wastes which may be disposed of through household septic systems and which can leach into water supplies. In addition, transportation corridors are susceptible to accidental spills of hazardous materials in transport.

c. Existing Conditions. Within the study area, 227 acres are zoned for business use, 574 acres are zoned for industrial use, 5625 acres are zoned residential, and 47 acres are used for transportation. There is a potential for hazardous materials usage and the generation of hazardous wastes with all of these land uses. There are 132 RCRA (Resource Conservation and Recovery Act) hazardous waste handlers on the 1986 RCRA list for the study area (see table 4-8). However, the regulatory list may not be entirely comprehensive and may overlook smaller businesses that could also be handling hazardous materials. All of the South Shore communities have held household hazardous waste collections, with the exception of Hanson, Pembroke and Rockland.

Table 4-8
SOUTH SHORE RCRA HAZARDOUS WASTE HANDLERS

Facility	Address	Activity Type 1	Regulatory Status 2
COHASSET			
Comm of Mass Site	Route 3A	G	
Dwyer Fabricae	754 CJCH Way	G	
H & W Industries Inc.	155 King St.	G	2
Hagertys Cohasset Colonials			1
Spensley Chevrolet Inc.	828 CJCH Way	G	2
Webb Jervis Co. Inc.	155 King St.	G	2
DUXBURY			
Anton's Cleaners Inc.	Depot St.	G	2
Batelle New England Marine	397 Washington	G	2
Hollis Alvin & Company	96 Alden St.		1
HANOVER			
BIW Cable Systems Inc.	369-375 Winter	G	
Bay State Color	76 Rockland St.	G	2
Browne	828 Washington St.	G	
Crawford Products	301 Winter St.	G	2
Haldon Lincoln Mercury*	572 Washington St.	G	
Halliday Lithograph Corp.*	Circuit St.	U	
Hanover Auto Body Inc.	709 Washington St.	G	2
Hollis Alvin & Company	819 Washington St.		1
Peterson & Nash Inc.*	219 Winter St.	G	2
Sutterland Machine Co.	872 Main St.		1
South Shore Lincoln Press	Hanover Mall Rte. 53	G	2
Universal Tipping Co. Inc.	360 Water St.		1

Facility	Address	Activity Type 1	Regulatory Status 2
HANSON			
Eastern Machine & Design	1062 Main St.	G	2
Imperial Cabinet Corp.	1000 Main St.		1
Lite Control Corp.	Hawks Ave	G	
HINGHAM			
Best Chevrolet	128 Derby St.	G	2
Building 19 Inc.	349 Lincoln St.	G	
Eastern Medical Plastics	27 Fottler Rd.		1
Eastern Process Co.	2 Churchill Rd.	G	
High Vacuum Equipment	110 Ind. Park Rd.	G	2
Hingham Municipal Light	308 Cushing St.	G	
MacKenzie Machine	25 Mill Lane	G	2
Markings Inc.	85 Research Rd.	G	2
Massa Products	280 Lincoln St.	G	
Merriman (Div. Quanco)	100 Ind. Park Rd.	G,T	4
Meterex Corp	25 Ind. Park	G	2
N. E. Book Components	125 Indust. Park Rd.	G	
N. E. Sciences, Inc.	55 Indust. Park Rd.	G	
Pyrotector, Inc.	333 Lincoln St.	G	
IRW, Inc.	10 Keith Way		1
Twin City Laundry	193 Lincoln St.	G	2
U.S. Repeating Arms	100 Research Rd.	G	
U.S. G.S.A. Supply Dist.	295 Lincoln St.	G	
Vulcan Co.	51 Sharp St.	G	
MARSHFIELD			
Antons Cleaners of Marshfield	668 Plain Rte. 139	G	2
Cabinets by Sunny	586 Pine Street		1
N.E. Ind. Floor Coating	121 Idyl Wilde	G	
Paul McGuire Chevrolet Inc.	923 Plain Street		2
Plaza Cleaners	933R Webster St.	G	2
Sampsons Auto Body	903 Plain		2
Schulders William J.	56 Napier Rd.		
NORWELL			
Atlantic Towing	271 Washington St.	G	2
Boston Whaler Inc.	412 Washington St.	G	
Colonial Village Refinishing	335 Washington St.	G,T	2
Fabric Care House	62 Pond St.	G	2
Fabricare House	32 Pond St.	G	2
Hancock Paint & Varnish Co.	109 Accord Park Dr.	G	2
Norwell One Stop One Stop Cleaners	Rte. 53	G	2
Queen Anne Cleaners	10 Washington St.	G	2
Queen Anne Arco	10 Washington St.	G	
Rietzl Porche Audi Inc.	59 Pond St.		
Smith Print Inc.	90 Longwater Dr.	G	2

Facility	Address	Activity Type 1	Regulatory Status 2
PEMBROKE			
Hollis Alvin & Company	Washington St.		1
Hyer Industries Inc.	Rte. 139	G	2
King Collision Center Inc.	38 Schooset St., Rte. 139	G	2
Markings Inc.	30 Riverside Dr.	G	2
North River Martinizing Dry Cleaning	North River Plaza, Rte. 139	G	2
North River Nursing Home	35 Washington St.	G	
Protectowire Co.	2 Old Washington St.		1
R & F Micro-Tool Company	720 Washington St.	G	
Realtron Systems	7 Riverside Dr.	G	2
Russ Steele Inc.	32 Schoosett St.	G	2
Shell Service Station	Church & Oak St.	G	2
ROCKLAND			
Arnold H.H. Co. Inc.	529 Liberty St.	G	2
AMD Engineering	Maple & Plain Sts.	G	2
Boston Whaler Inc.	1149 Hingham St.		
Buckley Corp.	175 Union St.	G	
Codman F.L. & J.C. Co.	Plain St.		
D & E Cleaners	169 Market St.	G	2
Del Manor Nursing	56 Webster St.	G	
Electro Signal Lab Inc.	1022 Hingham St.	G	2
Globe Rubber Works Inc.	254 Beech St.	G	2
Grove Auto Body Inc.	128 Grove St.	G	2
Harland John H.C.	201 Union St.		1
John H. Harland Co.	85 Longwater St.	G	2
McLaughlin Dental Lab	496 Union St.		1
National Coating Corp.	254 Beech St.	G	
Polymer Design	180 Pleasant St.	G	2
Progressive Equipment	241 W. Water St.	G	
Transworld Adhesive & Chemical Co./Air Station Industrial Park		G	2
Venture Tape Corp.	30 Commerce Rd.	G	2
SCITUATE			
Buckley & Scott	340 Gannett Rd.	G	
Goulston George A. Co.*	1000 Crescent Blvd.	G	2
Scituate Cleaners	41 Front St.	G	2
South Shore Publishing	777 Country Way	G	
Sta Neet Cleaners	363 Gannett Rd.	G	2
WEYMOUTH			
Arco Service Station	325 Ralph Talbot St.	G	2
Badger Company Inc.*	56 Woodrock Rd.	G	
Bayside Auto Service Inc.	198 Bridge St.	G	2
Boston Edison	1 Bridge St.	G	
Brava Cleaners	59 Washington St.	G	2

Facility	Address	Activity Type [1]	Regulatory Status [2]
WEYMOUTH (continued)			
Castall Inc.	Weymouth Ind. Park	G	2
Dresco Belting Co. Inc.	122 East St.		1
Electro Switch Corp.	120 King Avenue	G	
Hollis Alvia and Co.	100 Pond St.		
Jannell Motors Inc.	1068 Main St.	G	2
Johnson A. Energy Marketing Inc.	5 Bridge St.	G	
Maaco	71 Moore Rd.	G	2
Mass. Electric Co.	186 Main St.	G	2
Master Cleaners Inc.	1407 Commercial St.	G	2
Microsonics Inc.	60 Winter St.	G	2
New England Sciences Inc.	541 Main St.	G	
Plaza Cleaners	114 Main St.	G	2
Richards Cleanrama*	230 Bridge St.	G	2
Ricky Smith Pontiac Inc.	25 Main St.		2
Ross Auto Body	134 East Street	G	2
Drycleaning by Dorothy	485 Columbian	G	2
Serono Laboratories Inc.*	26 Rockway Ave.	G	2
Shea Inc.	805 Washington St.	G	2
Smith Print	Weymouth Ind. Park	G	2
Thomas S.B. Sahara*	45 Finnell Drive	G,T	
U.S. Coast Guard*	Trotter Rd.		
U.S. Naval Air Station*			

[1]Activity Type: G = Generator
T = Treat, store and/or dispose
U = Underground injection control

[2]Regulatory Status: 1 Non-regulated (non-handler)
2 Non-regulated (small quantity)

* Major RCRA hauler

6. Pesticides

a. Potential Impacts. The term pesticides includes insecticides, fungicides, herbicides, and rodenticides. These are all chemical compounds used to control unwanted organisms such as insects, weeds, and rodents. Since the compounds vary depending on their target organism, their potential effects on water supplies by direct infiltration through the ground or by way of runoff. Impacts on water supplies may be caused by improper use, storage, or disposal of pesticide products. In some locations, even properly regulated applications may have the potential to contaminate water supplies.

b. Related Land Uses. Land uses associated with pesticide applications include residential, commercial, industrial parks, institutional, transportational, utility (electrical), agricultural, and recreational. For instance, homeowners use pesticides to control insects, weeds, and rodents in gardens and homes.

Municipal departments of public works often use herbicides and fungicides to maintain landscaped areas. County mosquito control programs apply larvicides directly to surface water bodies and spray adulticides weekly during summer months to control mosquitoes.

Utility companies use selective herbicides applications to eliminate tall-growing trees that interfere with the function of the utility lines. The general amount of herbicide used for this is less than one gallon per acre. Under new state regulations, however, no foliar application of herbicide is allowed to control vegetation greater than 12 feet in height, except for side trimming.

The intent of railroad herbicide application is to control all vegetation along the track since plant overgrowth may cause degradation of the track or lead to fires. In most cases, the area treated extends about 12 feet to either side of the center of the track, known as the railroad layout or ballast. [Note: In those areas set within 100 feet of a wetland, state regulations restrict herbicide application within 10 feet of the wetland and beyond 9 feet of the centerline of the track.] A number of chemicals are used together that generally amount to 5 to 8 gallons per acre.

Water-soluble herbicides may be used directly in standing water bodies for control of aquatic plants under a permit from the DEQE, Division of Waterways These compounds also may reach water bodies by accidental drift from equipment clean up after application.

c. Existing Conditions. There are no active railroad beds in the study area and very little agricultural land use, (321 acres in the intercommunity areas and 3,269 acres region wide). Consequently, the greatest risk of contamination would originate from utility rights of way and residences.

7. Mining

a. Characteristics and Water Supply Impacts. Sand and gravel is considered New England's most valuable mineral resource. As much as 90% of Massachusett's groundwater aquifers are found in areas containing sand and gravel deposits. Mining in these areas may cause adverse impacts to the quality and quantity of groundwater

supplies. Removal of earth material above a water table reduces the degree of filtration of precipitation and runoff before the recharge waters reach the aquifer. Also, uses associated with mining, such as sand/salt mixing and gasoline and oil storage to maintain mining equipment can threaten groundwater. The quality of recharge may be diminished due to sand and gravel operations. Excavation may inhibit the downward flow or percolation of recharge waters by altering slopes, compaction, or altering drainage patterns. Increased evapotranspiration may occur if enough earth material is removed such that plant roots can reach the groundwater. Therefore, sand and gravel operations should be regulated properly to protect against the degradation of groundwater resources. Mining poses a threat to groundwater if the excavation reaches too close to the water table, not leaving a sufficient buffer zone for contaminants to be filtered out. Future land uses on abandoned mines should also be carefully regulated, considering the potential groundwater impacts.

b. Related Land Uses. Mining; sand and gravel excavation.

c. Existing Conditions. Within the region there is approximately 1,000 acres of mined lands (1984 MacConnell land use data). However, only about 100 acres of mined lands fall within the intercommunity study area.

Chapter 5

ZONING AND REGULATION OF LAND USE

The preceding chapter focused on land uses that have potential impacts on water supplies. This chapter summarizes existing local, state, and federal laws and regulations that control those land uses. The zoning bylaws and ordinances for each municipality also are examined in an effort to assess the potential impacts of future development and their compatibility with water supply protection. This regulatory analysis will form the basis of the recommendations made in the next chapter.

EXISTING REGULATIONS

A host of local, state, and federal laws and regulations currently exist which regulate the land uses identified in the preceding chapter as having potential water quality impacts. These laws and regulations are summarized in Figure 5-1 and described below.

Underground Storage Tanks

- Federal. EPA is developing new requirements that will set minimum standards for state regulations of underground fuel storage. There are no federal regulations for underground storage of hazardous materials.

- State. The Board of Fire Prevention Regulations has issued new regulations (527 CMR9.00) for underground storage of fuel which require:

  - tank registration
  - inventory control
  - non-corrosive tanks
  - periodic tank testing
  - removal of abandoned tanks

  Residential and farm gasoline tanks less than 1,000 gallons, as well as heating oil tanks connected to burning equipment, are exempt from these regulations. For these kinds of tanks, there are few measures to prevent tank contents from contaminating water supplies if a leak should occur. There are no state regulations controlling underground storage of hazardous materials.

- Local. Marshfield, Norwell and Weymouth have underground fuel storage regulations. In Marshfield any person or business requesting a license or permit for fuel storage is required to build a reinforced concrete tank lined with fiberglass or an approved epoxy paint. An observation pipe must be provided for inspection purposes, as well as two monitoring wells located outside of tank. Norwell and Weymouth have adopted general bylaws which regulate underground fuel storage. They requires of all

existing underground tanks, installation standards for new and replacement tanks, and equipment replacement when leakage is confirmed. Similarly, Hingham has adopted a zoning overlay district, the Accord Pond Watershed Protection District, which prohibits the use of toxic or hazardous substances within its borders. Only by special permit are petroleum products allowed to be stored. Any existing storage tank not in use must be removed and any existing tank that is in use must be tested for leakage.

Wastewater

- Federal. Industrial and sanitary wastewater discharges to surface waters are regulated by the Clean Water Act, which sets standards for discharges through the National Pollution Discharge Elimination System (NPDES) Permit Program. (The NPDES program is implemented jointly by the Federal Environmental Protection Agency (EPA) and the State DEQE. The state has applied for delegation authority.)

- State. Disposal of sanitary wastewater is regulated by local boards of health under the State Environmental Code (Title 5). The regulations set requirements for the siting and construction of on-site septic systems. Local boards of health may adopt reasonable regulations more stringent than Title 5.

  Discharges of sanitary wastewater to groundwater in excess of 15,000 gallons per day is controlled by DEQE under the Groundwater Discharge Regulations (314 CMR 5.00). All discharges must meet Surface Water Quality Standards (314 CMR 6.00). These standards stipulate that discharge to Class I and II groundwater (or sources of potable water) must meet drinking water standards, while discharges to Class III groundwaters (or groundwater used for purposes other than potable water supply) may not contain pollutants in concentrations toxic to humans or causing significant adverse environmental effects.

- Local. Several towns in the South Shore region have adopted more stringent regulations than that which is required by Title 5. Duxbury, Hanover and Norwell have adopted stricter leaching area and setback requirements, Marshfield also adopted more stringent leach area, setbacks, and percolation rate requirements. Hingham has adopted wider setback requirements.

Road Salt

- Federal/State. There are no state or federal regulations governing the application of road salt. The state policy is to treat all state roads under icy or snowy conditions with 100% salt at an application rate of 300 pounds per lane-mile. However, there are state and federal constraints on the amount of salt in potable drinking water supplies.

Drinking water standards as set out in the Safe Drinking Water Act (310 CMR 22.00) require that sodium levels not exceed 15 mg/ , the water supplier must notify its customers of the high sodium level and potential hazards to health.

The Mass DPW has adopted a reduced salt policy for several critical water supply watersheds throughout the state. The DPW is also currently conducting a Generic EIR (Environmental Impact Report). The report is being required to explore the impacts of road deicing procedures on water supplies. The result of the GEIR study program is expected to assist in the develop of public policy with regard to road salt application.

- o Local. In Hanover, within the Water Resource Protection District, the application of road salt to private property and private parking lots is prohibited. Marshfield has several salt free zones and one area designated as a low salt zone to protect municipal wells. Norwell has a limit on the amount of salt to be used in one year (maximum of 1200 tons). In addition, there are three low salt areas within the aquifer area.

Leachate

Federal. There are no federal regulations concerning sanitary landfills.

- o State. Landfills are operated under DEQE regulations (310 CMR 19.00). These cover site selection, construction, cover material, litter and dust control, drainage of surface water, and completion and final cover of the landfill.

New state regulations have been drafted that afford much greater protection to groundwater. The new regulations require an impervious liner, groundwater monitoring systems, runoff guidance, and landfill capping. Although not formally adopted as state regulations, DEQE has been applying the standards of the new regulations to new or expanded landfills.

- o Local. There are no local regulations controlling landfills. However, local Boards of Health have the responsibility of site review and assignment.

Hazardous Waste and Materials

- o Federal. Hazardous waste generation, treatment, storage, transportation,and disposal are regulated by the Resource Conservation and Recovery Act (RCRA). The EPA has delegated authority to the Commonwealth of Massachusetts to carry out the program.

- State. The Massachusetts Hazardous Waste Management Act (Chapter 21C) and the DEQE hazardous waste regulations (310 CMR 30) establish a system of stringent control over hazardous wastes. All waste generators above a minimum threshold size are registered, and all wastes produced are accounted for in a "cradle-to-grave" manifest system. All wastes must be handled by licensed haulers and disposal facilities. There are standards for facilities which treat, store, and dispose of hazardous wastes. Waste generators are classified as large quantity generators if they generate over 1,000 kilograms per month of non-acutely hazardous wastes. Quantities of waste above the large quantity threshold must be removed from the site within 90 days. Smaller quantity generators are defined as those which generate between 20 and 1,000 kilograms per month of non-acutely hazardous wastes. Waste generators below that threshold are not regulated.

  DEQE is currently drafting household hazardous waste regulations to assist communities in conducting household hazardous waste collections. DEM has provided several grants to communities for household hazardous waste collections, however the program is not currently funded.

- Local. There are no local regulations controlling hazardous wastes and materials.

Pesticides

- Federal. The EPA tests pesticide products and approves their use, with label instructions for proper use.

  State. The Massachusetts Pesticide Board promulgated regulations for use of herbicides on rights-of-way in 1987 under 333 CMR 11.00. The regulations require that municipalities, utilities, and other organizations responsible for controlling vegetation on rights-of-way develop a Vegetation Management Plan and Yearly Operating Plan to be approved by the Department of Food and Agriculture. The regulations lay out specific controls on the use of herbicide regarding the height of vegetation, weather conditions during applications. They also state that no handling, mixing, or loading of an herbicide concentrate is allowed on a right-of-way within 100 feet of a sensitive area, defined as an area:

  (a) within the primary recharge area of a public drinking water supply;
  (b) within 400 feet of any surface water used as a public water supply;
  (c) within 100 feet of any appropriately marked private drinking water supply well;
  (d) within 100 feet of any standing or flowing water;
  (e) within 100 feet of any wetland;
  (f) within 100 feet of any agricultural or an inhabited area.

Under the regulations, municipalities may propose that the Department impose specific additional restrictions or conditions on the use of herbicides within or adjacent to sensitive areas as it determines necessary to protect human health or the environment. These allow for greater protection of public surface water supplies, private drinking water supplies, surface waters, wetlands, and an inhabited and agricultural areas.

- Local. Weymouth has adopted pesticide regulations which require that each year before April first, each party planning to apply pesticides must first submit a notice to the Board of Health describing the amount and practice of application to be used. Any pesticide with a manufacturers label restricting use where groundwater or surface water may be harmed is prohibited. A special permit process allows for the use of other pesticides if it is established that contamination will not result with application. Special permits require an Emergency Spill Response Plan, which includes the name of a responsible party, removal of contamination, and method of disposal. Spraying may not take place when the wind exceeds 5 mph.

Table 5-1
WATER RESOURCE PROTECTION MEASURES--SUMMARY

	Water Resource Zoning Overlay	Under-ground Fuel Reg's	Hazard Material Reg's	Herbicide Pesticide Reg's	B. of H. Septic Reg's	Road Salt Reg's
COHASSET	X					
DUXBURY	X					
HANOVER	X				X	X
HANSON	X					
HINGHAM	X					
MARSHFIELD		X			X	X
NORWELL		X			X	X
PEMBROKE						
ROCKLAND	X					
SCITUATE	X				X	
WEYMOUTH	X	X		X		
TOTAL	8	3	0	1	4	3

Table 5-2
SUMMARY OF WATER RESOURCE ZONING OVERLAY DISTRICTS

	COHA	DUXB	HANO	HING	ROCK	SCIT	WEYM
Residential Uses		P	P		P	P	P
Solid Waste Disposal	X	X			X	X	X
Junkyards	X	X	X		X	X	
Sewage Treatment		X				X	
Car/Truck Wash		X	X			X	
Road Salt Stockpiles	X	X			X	X	X
Underground Fuel	X			SP		X	
Dry Cleaning		X	X			X	
Motor Vehicle Repair		X	X			X	
Sale/Storage of Petrol	X	X	X			X	
Metal Plating		X				X	
Chem/Bacter Labs		X				X	
Herb/Pest Storage						SP	
Cabinet/Furn Making		X				X	
Painting etc.		X				X	
Photo Processing		X				X	
Machine Shops						X	
Printing		X				X	
Hazardous Materials	X	X	X	SP	X	X	
Herb/Pest Application		X					
Truck/Bus Terminals			X				
Hairdressing Salons			X				
Mining/Gravel Removal			X		X		
Wastewater Discharge	X		X		SP		
Haz Waste Generation		SP			SP		
Golf Courses		X				X	
Surface Impoundment							X
Discharge Toxic/Haz Mat.				X			
Sediment/Grease Trap			req				
Tank Leak Testing				req			
Max Lot Coverage			50%			35%	

P=Permitted SP=Special Permit X=Prohibited req=Required

ZONING

The preceding section summarized the laws and regulations which affect existing land uses in the towns. Zoning determines the type and intensity of development which may occur in the future within defined districts of the community. As such, it is one of the most important tools at the community's disposal to insure the long-term protection of its water supplies. By defining critical water resource areas and restricting future land uses within those areas, each community can insure that incompatible or hazardous land uses do not threaten water quality in the future. Sound management of land use in the aquifer and watershed areas will not only protect the public health, it will also help prevent a contamination incident which could cost millions of dollars in treatment and clean-up costs, and severely restrict availability of adequate water supplies.

The zoning districts in each of the South Shore communities is listed below in Table 5-3. Table 5-4 and 5-5 further describes the South Shore zoning by acreages located in intercommunity resource areas (aquifer and watershed). Table 5-6 summarizes intercommunity zoning acreages and percentages. Figure 5-1 is a pie chart illustrating intercommunity water resource percentages.

Table 5-3
SOUTH SHORE ZONING

DISTRICT		MINIMUM LOT AREA (s.f.)	MAXIMUM %COVERAGE
COHASSET			
Residence A -	single family dwelling	12,000	30
	2-family conversion	16,000 + 4,000 for each over 2	30
	community facility	12,000	30
Residence B -	single family dwelling	12,000	30
	2-family conversion	27,000 + 4,000 for each over 2	30
		20,000	30
Residence C -	single family dwelling	30,000	30
	2-family conversion	40,000 + 4,000 for each over 2	30
	community facility	30,000	30
	funeral home, mortuary	40,000	30
	nursing/convalescent home	40,000	30
Business	Downtown/Village Business	40,000	80
	dwelling for more than 1 family	40,000 + 4,000 for each over 2	25
	Waterfront Business	no requirements	50
	dwelling for more than 1 family	40,000 + 4,000 for each over 2	25
	Highway Business	10,000	50
	dwelling for more than 1	88,000	25
Industry	Light Industry	80,000	50
DUXBURY			
Residential Compatibility		40,000	15
		Residential only-	10
Planned Development		40,000	20
		Residential only-	10
Planned Development		40,000	28
		Residential only-	17
Planned Development		40,000	35
		Residential only -	20
Neighborhood Business 1, 2, 3		40,000	50
Neighborhood Business	none		60/70
Neighborhood Business	none	20,000	

DISTRICT	MINIMUM LOT AREA (s.f.)	MAXIMUM %COVERAGE
HANOVER		
Residential	30,000	
Business	44,000	high traffic retail- 12
Commercial	44,000	general retail- 15
Limited Industrial	44,000	plus parking and disposal- 60
Recreation-Conservation	44,000	10
HANSON		
Agriculture-Recreation	40,000	10
Residence AA	40,000	
Residence A	30,000	
Residence B	30,000	
Business	44,000	15
Commercial-Industrial	44,000	15
HINGHAM		
Residence A	20,000	
Residence B	30,000	
Residence C	40,000	
Residence D - Townhouse	5,000*	20
- other than Townhouse	30,000	
Residence E	30,000	
- 1 Family planned	10,000	20
- Town house planned	5,000*	20
- Garden apartment	5,000*	20
Residence F - Single Family	20,000	
- Townhouse	5,000*	20
- Garden apartment	5,000*	20
Business A		25
Business B		25
Business Recreation	10,000	25
Waterfront Business	10,000	25
Waterfront Recreation	3 acres	20
Industrial	80,000	40
Retail Group in Industrial	5 acres	30
Industrial Park	2 acres	40
Retail Group in Industrial Park	15 acres	20
Office Park	5 acres	
Limited Industrial Park	2 acres	30
Official and Open Space		10

* unit of one bedroom, for each additional bedroom 1,000 square feet is required.

DISTRICT	MINIMUM LOT AREA (s.f.)		MAXIMUM %COVERAGE
MARSHFIELD			
Residential - Rural	43,560		15
- Cluster development	20,000		25
Residential - Suburban	20,000		25
Residential - Waterfront	10,000		40
Office Park	20,000		40
Business General	10,000		none
Business Highway	20,000		40
Business Neighborhood	5,000		40
Business Waterfront	10,000		60
Industrial	40,000		none
- planned development	15 acres		
Airport	20,000		40
NORWELL			
Residential	44,000		
Business A	44,000	banks, restaurants-	12
Business B	44,000	business C2-	24.5
Business C	44,000	all others-	18
PEMBROKE			
Residential A	40,000		25
Residential - Commercial	120,000		35
Business A	40,000		25
Business B	80,000		
Industrial	80,000		50
Flood Plain Watershed Protection District			
ROCKLAND			
Residence 1	21,780		25
Residence 2	21,780		30
Residence 3	21,780		35
Residence 4	21,780		40
Business 1	none		80
Business 2	none		50
Limited Industrial	none		50
Industrial Park	none		50
Watershed Protection District	none		

DISTRICT	MINIMUM LOT AREA (s.f.)	MAXIMUM %COVERAGE
SCITUATE		
Residence A-1	40,000	
Residence A-2	20,000	
Residence A-3	10,000	
General Business	10,000	
Commercial	12,000	
Residence Multi-family	40,000	
Saltmarsh and Tideland Conservation District - no structure erected except non-commercial docks, cat walks, wharves or floats, no area may be filled, drained, dredged or excavated.		
Floodplain and Watershed Protection District		
Flood Insurance District		
Planned Development District		
WEYMOUTH		
Residential - low density	15,000	30
Residential - high density A	15,000	minimum 15 landscaped
- high density B	15,000	minimum 15 landscaped
Neighborhood Center District	7,500	none
Business - Limited business	10,000	50 and 10 landscaped
- general business	none	none
Industrial - industrial park	20,000	0 and 10 landscaped
general industrial	none	none
planned industrial park	43,560	with paved area- 60
Open Space District	20,000	80
Floodplain District		
Watershed Protection District	25,000	

Table 5-4
ZONING IN INTERCOMMUNITY AQUIFER AREAS

AQUIFER LOCATION: PEMBROKE and DUXBURY

ZONING	PEMBROKE (acres)	DUXBURY (acres)	TOTAL
Residential (> 40,000)	125	26	151
Planned Development		19	19
Open Space/Public		2	2
Wetlands Protection		15	15
TOTAL	125	62	187

AQUIFER LOCATION: DUXBURY and MARSHFIELD

ZONING	DUXBURY (acres)	MARSHFIELD (acres)	TOTAL
Residential (< 40,000)		414	414
Residential (> 40,000)	172	286	458
Planned Development	172		172
Business		14	14
Wetlands Protection	163		163
TOTAL	507	714	1221

AQUIFER LOCATION: HANOVER and NORWELL

ZONING	HANOVER (acres)	NORWELL (acres)	TOTAL
Residential (< 40,000)	71		71
Residential (> 40,000)		119	119
Industrial	71		71
TOTAL	142	119	261

AQUIFER LOCATION: PEMBROKE and HANSON

ZONING	PEMBROKE (acres)	HANSON (acres)	TOTAL
Residential (< 40,000)		107	107
Residential (> 40,000)	1040		1040
Business	23		23
Wetland Protection	106	84	190
TOTAL	1169	191	1360

AQUIFER LOCATION: ROCKLAND and HANOVER

ZONING	ROCKLAND (acres)	HANOVER (acres)	TOTAL
Residential (< 40,000)	84	34	118
TOTAL	84	34	118

AQUIFER LOCATION: HINGHAM and NORWELL

ZONING	HINGHAM (acres)	NORWELL (acres)	TOTAL
Residential (< 40,000)	148		148
Residential (> 40,000)		166	166
Open Space/Public	67		67
TOTAL	215	166	381

Table 5-5
ZONING IN INTERCOMMUNITY WATERSHED AREAS

Water Source: Whitman's Pond
Location: Weymouth
Watershed Area: Rockland and Hingham

ZONING	ROCKLAND (acres)	HINGHAM (acres)	TOTAL
Residential (< 40,000)	74	17	91
Industrial	98	395	493
Transportation	218		218
TOTAL	390	412	802

Water Source: Accord Pond
Location: Hingham, Rockland, and Norwell
Watershed Areas: Rockland and Norwell

ZONING	ROCKLAND (acres)	NORWELL (acres)	TOTAL
Residential (< 40,000)	40		40
Residential (> 40,000)		44	44
Business	7	183	190
Transportation	29	5	34
TOTAL	76	232	308

Water Source: Hingham Street Reservoir
Location: Rockland
Watershed Area: Hingham

ZONING	HINGHAM (acres)	TOTAL
Industrial	22	22
Transportation	1	1
TOTAL	23	23

Water Source: Aaron River/Bound Brook
Location: Cohasset
Watershed Areas: Norwell, Hingham,and Scituate

ZONING	NORWELL (acres)	HINGHAM (acres)	SCITUATE (acre)	TOTAL
Residential (< 40,000)		10		10
Residential (> 40,000)	2008		415	2423
Open Space/Public		1120		1120
TOTAL	2008	1130	415	3553

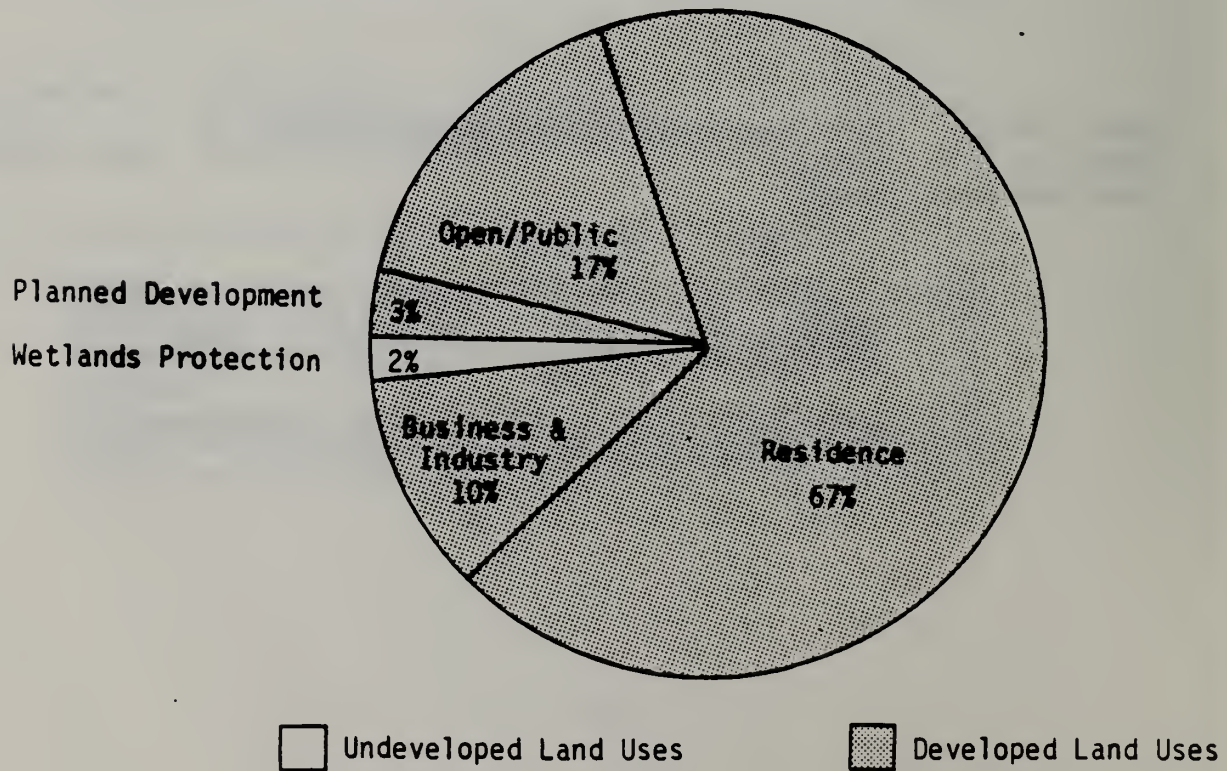
Water Source: First Herring Brook/Tack Factory Pond
Location: Scituate
Watershed Area: Norwell

ZONING	NORWELL (acres)	TOTAL
Residential (> 40,000)	450	450
TOTAL	450	450

Table 5-6
ZONING SUMMARY IN INTERCOMMUNITY WATER RESOURCE AREAS

ZONING DISTRICT	WATERSHEDS (acres)	%	AQUIFERS (acres)	%	TOTAL (acres)	%
Residence (40,000 s.f.)	141	2.7	858	19.7	999	9.3
Residence (240,000 s.f.)	2917	56.8	1934	60.0	4851	58.0
Total-RESIDENTIAL	3058	59.5	2792	79.8	5850	67.3
Planned Development			191	5.9	191	2.4
Business	190	3.7	37	1.1	227	2.7
Industrial	150	9.8	71	2.2	586	6.9
Transportation	253	0.9			253	0.6
Open Space/ Public	1120	26.1	69	2.2	1189	16.7
Wetlands Protection			368	8.8	368	3.4
TOTAL	5136	100.0	3528	100.0	8664	100.0

Figure 5-1
Intercommunity Water and Aquifer Area Zoning



Chapter 6

FINDINGS AND RECOMMENDATIONS

Major Findings

South Shore communities rely upon surface and groundwater resources within the North and South River basins and the Weymouth and Weir River basins. Groundwater represents 70 percent of the area's supplies, with a safe yield of 33 million gallons per day available in 52 wells across the region. Surface water provides a safe yield of about 15 million gallons per day, available from eight reservoirs.

Water demand in the twelve communities average about 19 million gallons per day, and reaches a maximum of about 35 million gallons per day in the summer. Several communities experience difficulties in meeting peak demands, and outdoor watering bans and other conservation measures are frequently enforced.

Water quality problems are severe in only one community to date. Marshfield lost several wells to organic chemical contamination in 1986. Trace amounts of chemicals have been detected in several other communities, but no other sources have been closed due to contamination. Water treatment is provided in seven communities.

Emergency sources are very limited, with most towns relying upon marginal standby wells and/or connections with neighboring towns. Therefore, contamination of any town's water supplies could have repercussions for the whole region.

Although each town relies upon sources within its own boundaries (except Hull and Rockland), the surface and groundwater sources are strongly connected at a regional level. Aquifers and watersheds, which feed wells and reservoirs, extend beyond community boundaries. Of the 16,500 acres of reservoir watershed lands in the region, 5,100 acres, or nearly one third, extend beyond the boundaries of the communities in which the reservoirs are located. There are also about 3,200 acres of aquifer lands which straddle community boundaries. These intercommunity resource areas, which total about 8,350 acres, are the focus of this study. Within these areas, the water supplies of neighboring communities may be impacted by activities which are beyond the control of those communities.

Although most of the South Shore communities have initiated or implemented water resource protection programs within their own boundaries, only one small portion of the intercommunity water resource area (in Scituate) has been provided with protection. Regional cooperation is essential to prevent these areas from "falling through the cracks".

The land use in the intercommunity resource areas is largely of low intensity or undeveloped categories. However, there are 1,250 acres of residential development, 90 acres of commercial, and 96 acres of industrial land uses. Developed land use represent 19 percent of the total area.

Zoning of the intercommunity resource areas is two-thirds residential, with most of that one-acre or greater lot sizes. However, the existing zoning would allow 227 acres of business uses and 574 acres of industrial uses within the intercommunity watershed and aquifer areas.

Potential sources of contamination include seven landfills, two auto dumps, and five surface impoundments. There are over 450 underground fuel tanks in the South Shore region, many of which are within the watershed and aquifer areas, and there are countless more residential heating oil tanks in the ground. Use of road salt, especially on state highways, contributes to elevated sodium levels in several towns. The planned widening of Route 3 could exacerbate this problem, although a concerted effort by the towns for mitigation measures may alleviate the situation in the future.

In summary, the intercommunity water resources identified in this study are at greater risk because they have fallen through the cracks in each town's individual water protection planning. But the water resources are a regional resource, and their overall management and protection is in the interest of all communities in the region. Regional cooperation is needed to insure that all water supply watersheds and aquifers are protected, regardless of their location.

Recommendations

In light of the above findings, the following recommendations are made to the South Shore Coalition by the South Shore Water Supply Protection Committee:

1. The communities of the South Shore Coalition should form a standing Water Supply Protection Advisory Committee. The committee could be formed by the signing of a Memorandum of Understanding by the towns' selectmen, and/or by the adoption of a model bylaw by Town Meeting in each community.

   The functions of such an advisory committee may include:

   - o to make recommendation relative to water supply protection measures which could be adopted by the towns under their independent home rule authority;
   - o to make recommendations relative to the adoption and promulgation of rules and regulations of several town boards;
   - o to consult together as a mechanism for joint local action for the resolution of water quality and water resource issues, including actions necessary for compliance with recent amendments to the Safe Drinking Water Act.

2. In order to increase the level of production of the region's drinking water resources, the communities should consider adopting the following water resource protection measures:

   - o a requirement that septic systems be inspected, and pumped if necessary, at the time of sale or transfer of a property;

   - o a requirement that residential underground fuel tanks be tested for leaks at the time of sale or transfer of a property;

   - o a supplemental Board of Health regulation which establishes a maximum percolation rate of two inches per minute, and prohibits the use of dewatered percolation tests for septic system approvals.

APPENDICES

APPENDIX A

SOUTH SHORE UNDERGROUND FUEL STORAGE LICENSES

Name & Address	No. of tanks	Capacity of Tank (Gallons)	Date Installed	Fuel
COHASSET				
Breen				
110 CJCH				
Rosano	1	1,000	1953	gas
233 CJCH				
Ezan, Sunoco	1	17,000	1957	gas
391 CJCH	2	5,000	1953	gas
	2	500	1953	waste & motor oil
Cohasset Motors	1	2,000	1957	gas
400 CJCH				
Poland	4	10,000	1956	gas
508 CJCH				marine gas
				kerosene
				waste oil
Goggin, Car Barn	1	9,500	1956	gas
574 CJCH	1	5,500	1950	gas
Leo's Exxon	1	8,000	1954	gas
734 CJCH	1	4,000	1957	gas
Anto Haus	1	3,000	1962	gas
742 CJCH				
Rice	1	3,000	1962	gas
749 CJCH				
Mitchell	1	6,000	1963	gas
805 CJCH	1	5,000	1956	gas
	1	2,000	1946	gas
	1	3,000	pre '36	gas
Highway Motors	1	3,000	1963	gas
827 CJCH	1	3,000	1963	gas
Spensley	1	16,000	1963	gas
838 CJCH	2	500	1963	waste & fuel oil
Charles Pape			1969	
94 King St.				
Webb Norfolk			1987	
155 King				
Parkinson, Mobil	1	18,580	1965	
Barnes	1	1,000	1947	gas
502 N. Main St.				
Robbins	1	9,000	1957	gas
409 N. Main St.	1	3,000	1946	gas
	1	3,000	1941	gas

Name & Address	No. of tanks	Capacity of Tank (Gallons)	Date Installed	Fuel
COHASSET (continued).				
Eastern Edison	1	2,000	1963	gas
365 N. Main St.				
Frank			1938	
354 N. Main St.				
Barnes	1	1,000	1947	gas
336 N. Main St.				
Rosano	1	1,000	1952	gas
325 N. Main St.				
Sun Oil	1	4,000	1961	gas
151 S. Main St.	1	1,000	1961	oil
	1	4,000	1957	gas
	1	8,000	1954	gas
	1	1,000	pre '54	
	1	1,500	pre '54	
Texaco	1	16,000	1960	gas
55 S. Main St.	1	1,000	1960	fuel oil
	1	500	1960	waste oil
	1	5,000	1955	gas
Thaxter	1	5,000	1947	gas
74 S. Main	2	600	1950	gas
Schiavo	1	2,000	1953	gas
147 S. Main St.	1	2,000	1952	gas
Sestito	1	1,000	1970	gas
185 S. Main St.				
Salt House	1	8,000	1957	gas
40 Border St.	2	2,000	1946	gas
Mill River Marine	1	3,000	1947	gas
82 Border St.				
Mobil	?	14,000	1957	gas
34 Elm and Margin	1	5,000	1947	gas
Salvador	1	1,000	1955	gas
43 Elm Court				
E.J. Antoine	2	2,000	1947	gas
40 Margin				
White				
103 Ripley				
Charles Pape	1	800	1956	gas
205 Sohier				
Brown Auto	1	4,000	1958	gas
22 Depot	1	9,000	1947	gas
	1	6,000	1935	gas
Silvia	1	1,000	1958	gas
10 Hill	1	500	1947	gas
Salvador	1	1,000	1947	gas
81 Salvador				
Golf Club				
Lambert Lane				

Name & Address	No. of tanks	Capacity of Tank (Gallons)	Date Installed	Fuel
COHASSET (continued).				
Bauch	1	2,000	1956	white gas
CJCH				
High School	1	10,000	1952	gas
143 Pond St.	1	10,000	1952	fuel oil
Osgood School	1	5,000	1951	fuel oil
35 Ripley Rd.				
HANOVER				
Eugene Zarella				
245 Broadway				
Frank Cervelli				
250 Center St.	1	1,000	1970	gas
Curtis Compact				
off Circuit St.		20,000	1970	gas
Joseph Ingle & Son				
Circuit St. and				
Mayflower Dr.				
Capeway Ice and				
Engineering Co.				
406 Columbia Rd.			1981	propane
Halloran Realty				
353 Circuit St.				
Sun Oil Co.				
Columbia Rd.		14,000		
Toni Service Stn.				
103 Columbia Rd.				
Arco Petroleum		25,000		
Products	1	10,000	1979	gas
309 Columbia Rd.				
Towne Pump Auto				
592 Hanover St.		5,500		gas
Skip's Auto Service		15,000		
1222 Hanover St.	1	5,000	1975	gas
James Gallant	1	1,000	1974	gas
1356 Hanover St.	1	3,000	1974	fuel oil
Standard Rubber Products		10,000		fuel oil
King St. at Sunnyside		10,000		fuel oil
Robert Setterland				
872 Main St.		3,000	1970	
Stoughton Steel Co.				
184 Myrtle St.	1	2,000	1961	gas
Thom Robinson				
69 Maple St.				
Richard DeMaranville				
582 Main St.				
Earl F. Simmons				
206 Silver St.	1	2,000	1957	gas
Cardinal Cushing				
376 Washington St.				

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
HANOVER (continued)				
Richardson-Lincoln-Mercury				
572 Washington St.		500		waste oil
Star Land Amusement Park Inc.	1	2,000	1970	gas
645 Washington St.				
Fisher Air Fasteners				
785 Washington St.		2,000	1973	gas
Prestige Dodge				
849 Washington St.		1,200	1970	waste & lube oil
DeBlois Oil Co.				
922 Washington St.		30,000	1974	gas
Mobil Oil Corp.				
1363 Washington St.		26,000	1973	gas
Mobil Oil Corp.				
1453 Washington St.		36,000	1977	gas
Zayre Corporation Hanover Mall				
1775 Washington St.	1	500	1970	waste oil
Kingston Oil and Gas Hanover Mall				
1775 Washington St.	4	1,000	1981	propane
Sullivan Tire				
1792 Washington St.	1	550	1973	waste oil
Texaco		26,000	1971	gas
1812 Washington St.	1	500		waste oil
	1	1,000		fuel oil
Sun Oil Co.				
1970 Washington St.	1	19,000	1968	gas
Prestige Buick				
2000 Washington St.		10,500	1970	
Getty		16,000	1973	
2122 Washington St.				
HINGHAM				
Catholic Foreign	1	1,500	1963	gas
Mission Society		25,000	1963	fuel oil
110 Charles	1	2,500	1976	gas
		25,000	1976	fuel oil
Hingham Light Dept.	1	2,000	1969	gas
308 Cushing St.	1	10,000	1974	gas
Sunoco	1	16,000	1960	gas
87 Derby St.	1	8,000	1985	gas
	1	1,000	1960	fuel oil
	1	1,000	1985	waste oil
Gas Country		36,000	1962	gas
100 Derby St.				

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
HINGHAM (continued)				
Best Chevrolet 128 Derby St.	1	2,000	1964	gas
Hingham Yacht Club 211 Downer	1	2,000	1964	gas
15 Fort Hill	1	1,000	1932	gas
19 Fort Hill	1	30,000	1973	gas
C. Spirito, Inc. 43 Fresh River Rd.	1	4,000	1974	gas
GMS Realty Trust 90 Industrial Park	1	15,000	1976	fuel oil
JRS Realty Trust	1	5,000	1974	gas
90 Industrial Park	2	5,000	1975	gas
Merriman 100 Industrial Park	1	15,000	1965	feul oil
New England Sealcoating 120 Industrial Park	1	10,000	1973	gas
Joseph Calvi 100 Kilby	1	3,000	1974	gas
Rocco V. Amonte 156 Kilby	1	10,000	1947	gas
Police 169 Lincoln	1	10,000	1974	gas
A.J.Exxon 179 Lincoln	1	15,000	1961	gas
George Morse 193 Lincoln	1	6,200	1957	fuel oil
Walter Secatore, Jr. 223 Lincoln		15,000	1962	gas
Higham Dodge 315 Lincoln	1	1,000	1964	gas
Allied Industries		60,000	1972	fuel oil
339 Lincoln		15,000		gas
Hewitt's Cove Marina 349 Lincoln		4,000	1964	gas
Yankee Oxygen 349 Lincoln			1971	
Curtlo Realty Trust 400 Lincoln	1	1,000	1971	flamable class A & B
Landfill Auto Service	1	10,000	1947	gas
421 Lincoln		24,000	1970	gas
H & A White, Shaw, Inc. 427 Lincoln	1	10,000	1955	gas
433 Lincoln	1	10,000	1958	gas
Chas. H. Cushing, Inc.	1	2,000	1934	gas
274 Main St.	1	12,000	1972	gas
Fire Dept. 339 Main St.	1	7,000	1976	diesel

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
HINGHAM (continued)				
Notre Dame	1	10,000	1964	fuel oil
1073 Main St.				
School Dept.		15,000	1961	fuel oil
1105 Main St.				
K. Brewer	1	1,000	1964	gas
161 New Bridge				
Wm. F. Quinn, Inc	1	10,000	1949	gas
13-15 North St.		14,000	1960	gas
Wm. F. Quinn				
36 North			1929	
Anthony Barbuto	1	3,000	1962	gas
Lot 19 Pine				
School Dept.		10,480	1953	fuel oil
41 Pleasant				
Pilgrim Skating Arena	1	1,000	1973	gas
75 Recreation Rd.				
Tronlox Trust	1	2,000	1968	gas
100 Research Rd.				
Paperama Development Trust		5,000	1980	gas
105 Research Rd.				
Royal Gas	1	10,000	1939	gas
168-170 Rockland Rd.				
345 Rockland Rd.		11,000	1972	gas
Higham Tree & Park Dept.	1	1,000	1971	gas
8 Short St.				
Shell Oil			1934	
9 Short St.			1950	
	1	6,000	1973	gas
	1	3,000	1985	gas
S.S. Country Club				
274 South St.				
Hingham Water Co.				
93 Pleasant St.				
Station North R.T.	1	10,000	1954	gas
6 Station St.				
Tom O'Brian	1	10,000	1945	gas
Chrysler Plymouth				
2-8 Summer St.				
Mobil Oil		20,000	1969	fuel oil
16 Summer	1	8,000	1984	gas
Hingham Car Wash	1	16,000	1967	gas
19 Summer St.	1	4,000	1977	diesel
	1	15,000		gas
Shell Oil		15,000	1965	gas
25 Summer St.		20,000	1970	gas
Vernon Conlin		10,000		gas
26 Summer				

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
HINGHAM (continued)				
Gulf (Chevron)		9,000	1936	gas
29 & 31 Summer St.		39,000	1981	
E. Margetts	1	1,000	1953	gas
97 Ward				
Getty	1	10,000	1949	gas
4 Whiting St.				
Gulf Oil	1	10,000	1956	gas
19-21 Whiting St.		20,000	1975	gas
Mortgage Shops, Inc.		14,000	1962	gas
(Amoco)		6,000	1975	gas
193 Whiting St.				
Mutual Oil	1	2,000	1930	gas
194 Whiting	1	10,000	1959	gas
	1	8,000	1974	gas
	1	10,000	1975	gas
Wm. Costa	1	8,000	1954	gas
270 Whiting				
Plymouth Quarries	1	500	1933	gas
410 Whiting	1	10,000	1973	gas
MARSHFIELD				
All-Town Inc.	1	3,000	1980	gas
43 Lone St.	1	3,000	1980	diesel
Bernard Ayre				
(Texaco)				
C.K. Smith &				
Co., Inc.	1	10,000	1981	gas
2170 Ocean St.	2	8,000	1981	gas
Biagini, Inc.				
288 Pleasant St.	1	1,000	1952	gas
Boch Realty Trust	1	3,000		gas
975 Plain St.	1	3,000		gas
	1	2,000		fuel oil
	1	1,000		waste oil
Cedar View				
Filling Station	n/a	9,000	?1952?	n/a
480 Careswell St.				
Cyr Oil Company				
(Texaco)	4	4,000	1965	gas
1892 Ocean St.	1	500	1965	gas
John N. Flagg, Jr. Inc	1	2,000	1982	gas
750 Webster Street	1	5,000	1982	diesel
Manuel Francis & Son, Inc. dba - Green Harbor Golf Club				
624 Webster St.	1	2,000	1984	gas
	1	5,000	1969	gas
Robert Frasca				
(Marshfield B.P.)				
969 Ocean St.				

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
MARSHFIELD (continued)				
High Point Realty	1	1,000	1958	gas
Trust	1	1,000	1964	diesel
900 Webster St.	1	1,000	1974	kerosene
	1	2,000	1974	gasoline
Humarock	2	1,000	1953	gasoline
Marina, Inc.	1	2,000	1953	gasoline
Sea & Ferry Sts.	1	4,000	1961	gasoline
Karl F. & Jutta				
Koertje	1	4,000	1978	diesel
1944 Main St.	2	4,000	1978	gas
Marina Harbor Corp.	1	10,000	1958	marine gas
Green Harbor Marina	1	10,000	1965	marine gas
Dyke Rd.	2	3,000	1978	marine gas
Paul Maguire	1	3,000	1968	gas
Chevrolet	1	2,000	1968	bulk oil
923 Plain St.	1	1,000	1968	waste oil
Edward F. McDonald	1	4,000	1945	gas
dba Marshfield Auto Body				
221 Summer St.	1	4,000	1945	gas
Marshfield Country				
Club	1	5,000	1974	gas
Nash Precast dba	1	10,000	1969	gas
Clay Pit Road &	1	5,000	1969	diesel
Ferry St.				
Mobil Oil Corp.	1	5,000	1972	gas
1933 Ocean St.	1	9,000	1981	gas
(Rte. 139)	1	5,000	1982	gas
	2	4,000	1982	gas
Old Colony Petroleum Co.				
2148 Ocean St.	1	6,000	1974	gas
(Rte 139)	4	4,000	1974	gas
Clark Philips	1	5,000	1970	gas
Ocean St. &	1	5,000	1970	gas
Plymouth Ave.				
Anthony Pomella	2	3,000	1965	gas
Fieldston Texaco	2	4,000	1965	gas
893 Ocean St.				
Rorke & Dennehy BFI	1	3,000	1973	gas
975 Plain St.	1	10,000	1973	gas
Shell Oil Co.	2	6,000	1967	gas
2126 Ocean St.	1	8,000	1967	fuel oil
	1	500	1967	gas
Sun Oil Co.	4	6,000	1982	diesel
2054 Ocean St.	1	1,000	1982	waste oil
	1	1,000	1982	heating oil
Taylor Marine Corp.	1	8,000	1973	diesel
95 Central & Plain	1	6,000	1982	gas
Realty Trust	2	10,000	1980	heating oil
Williams Coal & Oil	1	1,000	1980	diesel
717 Plain St.	1	500	1980	LP Gas

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
MARSHFIELD (continued)				
Mary E. Williams				
(Mary's)	1	1,000	1959	marine gas
2205 Main St.	1	4,000	1959	gas
Town of Marshfield	1	10,000	1974	gas
Highway Garage	n/a	12,000	1973	diesel
870 Moraine St.				
Town of Marshfield	2	6,000	1967	aviation
Airport				& gas
Marshfield Municipal Airport				
Old Colony Lane				
NORWELL				
Sears Roebuck	1	10,000	1974	Unleaded
55 Accord Park Drive				fuel
Rietzl Realty	1	2,000	1970	gas
59 Pond St.	1	1,000	1970	waste oil
	3	500	1970	lube oil
Prestige Imports	1	500	1968	oil
22 Pond St.	1	1,000	1968	waste oil
Hilltop Service		11,000	1970	gas
223 Main St.	1	3,000	1952	gas
	1	4,000	1970	gas
	2	2,000	1952	gas
Boston Whaler	1	5,000	1966	#4 fuel oil
412 Washingtron St.				
Expert Fence	1	5,000	1974	gas
171 Washington				
Sullivan Tire	2	3,000	1972	gas
119 Washington St.				
Hancock Paint	1	1,500	1969	Naptha
109 Accord Park Dr.	2	1,500	1969	Linseed
	2	1,500	1969	out of use
	1	1,500	1969	460 solvent
	1	5,000	1969	663 M.S.
	1	5,000	1969	fuel oil
AMN Limited	4	4,000	1967	gas
424 Washington St.	(Norwell Car Wash)			
Town Highway Dept.	2	5,000	1972	gas
310 Main St.	1	5,000	1972	diesel
Norwell Police Dept.	1	2,000	1970	gas
River St.				
Mobil Oil		27,000	1970	gas
85 Washington St.	1	500	1970	waste oil
	1	500	1970	fuel oil
Jiffy Lube	1	3,000	1985	lube oil
45 Washington St.	1	3,000	1985	waste oil
	1	1,000	1985	trans. fluid

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
NORWELL (continued)				
Hawkins Realty Trust	1	2,000	1974	gas
55 Washington St.				
Christy's Sunoco	1	2,000	1971	oil
95 Washington St.		18,000	1971	gas
Norwell Sunoco.	1	18,000	1968	gas
117 Pond St.	1	500	1968	waste oil
	1	500	1968	fuel oil
Shell Oil	3	8,000	1970	gas
72 Washington St.	1	500	1970	fuel oil
	1	500	1970	waste oil
Getty	2	4,000		gas
Pond & Whiting	1	4,000	1967	gas
Fredrickson	1	3,000	1972	fuel oil
441 Washington St.	1	1,000	1984	fuel oil
Joseph's Pontiac	1	3,000	1955	gas
724 Main St.	1	4,000	1974	gas
(GMC Truck)	1	4,000	1974	gas
	1	500	1955	waste oil
Shell Oil Company	3	12,000	1984	gas
10 Washington St.	1	500	1966	waste oil
PEMBROKE				
George Barbour	1	12,000	1958	gas
Washington St.		550		waste oil
Cities Service Co.				
Lorraine Carey		12,000	1969	gas
Lake & Plain Sts.				
Carey Motor Transp.				
Theresa Coffin	1	16,000	1970	gas
Washington &	2	550	1970	fuel &
Schosett Sts.				waste oil
Malcolm Connor	1	5,000	1959	gas
Cross St.				
Don's Sunoco	1	14,000	1957	gas
Center St. (Rt. 14)	2	500		fuel oil
				waste oil
Max Grieves	1	12,000	1959	gas
School St.				
Gulf Oil Company	1	10,000	1957	gas
Church & Oak Sts.	1	12,000	1965	gas
Henrich Enterprise Inc.	1	20,000	1966	gas
Mobil Oil Corp. Center		1,000	1966	fuel oil
& Mattakeesett Sts.		500		waste oil
		5,000	1971	gas
Markings Inc.	1	3,000	1985	diesel fuel
30 Riverside Drive				
Mobil Oil Corp.	1	32,000	1986	gas
Church & Oak St.	1	17,550	1986	fuel oil
	1	17,500	1969	

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
PEMBROKE (continued)				
Mobil Oil Corp.	2	12,000		gas
208 Church St.		5,000		diesel
		1,000		fuel oil
		500		waste oil
	1	5,000	1960	
	1	1,500	1983	
New England Villages, Inc.	1	2,000	1986	gas
664 School St.				
Old Colony Petroleum	1	7,000	1971	gas
Center St.	1	5,000	1971	gas
	2	1,000	1971	fuel oil
		1,000		waste oil
	1	18,670	1970	gas
		1,000	1970	waste & fuel oil
Pembroke Country Club			(issued 1938)	
75 Dwelley St.				
Town of Pembroke				
Mattakeesett St.	1	3,000	1963	gas
Ritchie, E.S. & Sons	1	1,000	1973	gas
243 Oak St.				
Anna Robideau				
School St. (Bill's Texaco)			(issued 1949)	
Shell Oil Company	1	30,000	1968	gas
Church St.	2	500	1968	waste oil
				fuel oil
	1	20,000	1968	gas
	2	500	1968	waste & fuel oil
Shell Oil Company	1	20,000	1968	gas
Washington St.	2	500		waste &
		500		fuel oil
	1	26,000	1979	gas
	2	500	1979	waste & fuel oil
Kenneth P. Wassmouth	1	10,000	1956	gas
Mattakeesett St.				
ROCKLAND				
Argyle Properties	1	5,000	1930	gas
476 Market St.				
Albert Culver Company	n/a			
175 Union St.				
Rudolph W. Childs	n/a			
234 North Avenue				
Craig & Johnson Inc.	(nothing underground?)			
265 Plain St.				

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
ROCKLAND (continued)				
Delmonico Trust	1	5,000	1982	diesel
415 V.F.W. Drive	1	5,000	1982	diesel
Gerald DelPrete	1	1,500	1960	gas
760 Summer St.	1	10,000	1980	gas
Don Robbins Oil	1	1,000	1939	gas
Co. Inc.	1	4,000	1967	gas
109-115 Hartsuff St.	1	4,000	1969	gas
Dry Ice Corp.	1	4,000	1982	gas
300 Hingham St.				
Exxon Corporation	1	5,000	1953	gas
116 Market St.	1	12,000	1957	gas
	1	16,000	1984	gas
Vicent Falco	(removed)	8,000	1949	
cor. North Ave. &	1	12,000	1983	gas
Plain St.				
Getty Refining &	1	5,000	1970	gas
Marketing Co.	2	550		fuel &
399 Webster St.				waste oil
Getty Refining &				
Marketing Co.	1	7,500	1949	
258 Union St.	(Tide Water Ass. Oil Co.)			
KSK Engineering	(nothing underground?)			
Corp.				
409 V.F.W. Drive				
Lannin Brothers	1	15,000	1957	gas
222 Webster St.	1	30,000	1979	gas
Nicholas McKinnon	1	2,000	removed 1987	
31 East Water St.		10,000	1980	gas
Mobil Oil Corporation	1	12,000	1984	gas
cor. Union & Market	1	10,000	1984	gas
	1	6,000	1984	gas
	1	6,000	1984	gas
Mutual Oil Company	1	10,000	1963	gas
49 Market St.	1	10,000	1972	gas
	2	10,000	1975	gas
Old Colony Petroleum	1	7,000	1950	gas
327 Market Street		10,000	1957	gas
		550		waste oil
		350		fuel oil
	1	4,000	1967	gas
	1	10,000	1980	gas
	1	40,000	1981	gas
Luigi C. Pace	1	4,000	1950	gas
820 Market St.	1	12,000	1962	gas
	1	12,000	1980	gas
Plymouth Eastern				
Development Co.	1	10,000	1946	fuel oil
Plain St.	1	20,000	1973	fuel oil
Frank H. Russso	n/a			
111 Hingham St.				

Name & Address	No. of tanks	Capacity of tank (Gallons)	Date Installed	Fuel
ROCKLAND (continued)				
So. Shore Industrial Development Trust (nothing underground?)				
197 V.F.W. Drive				
Ronald Tardanico	1	7,000	1946	gas
166 Union St.	1	3,250	1966	gas
	n/a	18,000	1985	gas
Triple A One Stop	2	4,000	1956	gas
688 Union St.		2,000		diesel
TACC Internat. Corp.	n/a			
Air Station Park				
SCITUATE				
Sunoco	1	4,000	1972	gas
Rte 3A & Mannlot	3	5,000	1969	gas
		500	1969	waste oil
Scituate Public Schools	1	2,000	1972	gas
Scituate Police Station	1	1,000	1971	gas
	1	1,000	1971	gas
Town of Scituate	1	1,000	1986	gas
Filtration Plant				
John R. Brown	1	2,000	1962	gas
225 Stockbridge Rd.				
Plymouth & Brockton	2	5,000	1972	gas
Street Railway Co.				
Andersen Fuel	1	2,000	1968	gas
19 Union St.				

APPENDIX B

1987 WATER SUPPLY ANALYSIS (mg/l)

	Marshfield												
	Mt. Stirgo #1	Furnace Brook Wells #1	#2	#3	#4	School Street	Webster Street #1	Ferry	Webster Street	Church Street #2	Union	Parsonage* Street	Street
TURBIDITY	0.1	0.0	0.1	0.2	0.2	0.1	0	0.0	1.9	0.1	0.0	0.6	0.9
SEDIMENT	0	0	0	0	0	0	0	0	0	0	0	0	0.9
COLOR	3	1	3	4	2	3	6	5	9	4	3	5	5
ODOR	0	0	0	0	0	0	0	0	0	0	0	0	0
pH	6.4	6.5	6.1	6.5	6.2	6.7	6.2	6.6	6.3	6.5	6.7	6.3	6.4
ALKALINITY-TOTAL	12	18	11	16	16	24	19	11	21	11	21	19	17
HARDNESS ($CaCo_3$)	18	46	37	57	33	42	44	12	94	26	26	30	31
CALCIUM (Ca)	4.2	11	9.0	13	8.3	9.9	9.0	2.7	22	6.1	5.5	6.3	6.6
MAGNESIUM (Mg)	1.6	4.4	3.4	5.8	3.3	4.2	5.2	1.2	9.4	2.6	2.9	3.3	3.2
SODIUM (Na)	8.8	2.4	26	19	14	12	17	7.1	25	9.4	6.6	18	17
POTASSIUM (K)	0.6	1.2	1.1	1.3	0.7	0.8	1.0	0.5	1.7	0.8	0.6	0.5	0.8
IRON (Fe)	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	--	--
MANGANESE	0.03	0.03	0.03	0.03	0.3	0.03	0.3	0.03	0.09	0.03	0.03	0.00	0.02
SULFATE (SO_4)	4	12	13	6	10	13	13	5	18	11	7	13	8
CHLORIDE (Cl)	14	44	48	46	22	21	24	9.0	7.0	17	9	31	26
SPEC. COND (u/cm)	83	219	213	212	138	143	176	68	326	105	88	150	135
NITROGEN (AMMONIA)	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
NITROGEN (NITRATE)	0.4	1.7	1.5	2.1	1.7	1.7	3.7	0.2	2.0	0.4	0.1	1.4	0
NITROGEN (NITRITE)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.01	--
COPPER (Cu)	.03	0.52	0.03	0.20	0.05	0.04	.11	1.1	0.22	0.05	0.03	0.03	0.03

*1985 data

	Duxbury						Abington/Rockland				
	Millbrook Pond	Depot Street	Lakeshore Drive	Millbrook Pond	Route 3A	Mayflower Street	Great Sandy Bottom Pond	Myers Ave WTP Raw	Myers Ave WTP Fin.	Hingham St. Filtration Plant Raw	Hingham St. Filtration Plant Fin.
TURBIDITY	0.4	0.1	0.1	0.2	0.2	5.0	1.6	6.3	0.3	1.4	0.2
SEDIMENT	0	0	0	0	0	0	0	0	0	0	0
COLOR	5	5	4	6	5	15	18	90	20	25	5
ODOR	0	0	0	0	0	0	0	0	0	0	0
pH	6.2	5.7	5.8	6.1	6.2	5.5	6.8	6.6	7.5	6.6	6.1
ALKALINITY-TOTAL	12	12	8	12	12	9	10	34	83	9	5
HARDNESS (CaCO3)	21	59	23	22	16	46	26	55	51	31	34
CALCIUM (Ca)	4.1	11	5.2	4.4	3.3	8.9	6.6	17	17	7.1	7.7
MAGNESIUM (Mg)	26	7.6	2.5	2.7	1.9	5.9	2.1	4.1	4.4	3.3	3.7
SODIUM (Na)	14	44	18	14	8.5	25	21	42	65	20	23
POTASSIUM (K)	1.2	2.8	1.8	1.3	0.8	1.9	1.4	2.3	3.8	1.0	1.0
IRON (Fe)	0.09	0.04	0.04	0.15	0.04	0.24	0.09	2.7	0.06	0.17	0.04
MANGANESE (Mn)	0.03	0.60	0.03	0.07	0.06	0.03	0.03	0.39	0.03	0.10	0.10
SULFATE (SO4)	2.0	36	10	2.0	2.0	11	14	24	19	14	20
CHLORIDE (Cl)	21	52	29	22	11	58	43	56	57	49	50
SPEC. COND. (u/cm)	125	317	143	126	82	243	191	301	393	208	232
NITROGEN (AMMONIA)	0.02	0.02	0.02	0.02	0.02	0.02	0.19	0.11	0.07	0.02	0.02
NITROGEN (NITRATE)	0.9	0.6	1.5	0.9	0.1	0.1	0.3	0.7	0.6	0.2	0.2
NITROGEN (NITRITE)	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.003	0.006	0.003	0.002
COPPER (Cu)	0.03	0.03	0.03	0.05	0.09	0.16	0.03	0.03	0.07	0.03	0.09

	Weymouth									Cohasset			
	Circuit Ave.	Winter St. W.T.P. Effluent	Main Street	Whitman Pond	Winter Street	Winter St. W.T.P. Raw	Great Pond Raw	Great Pond Finish	Swamp River Diversion to Great Pond	Aaron River Reservoir	Lily Pond W.T.P.	Elms Meadow	Lily Pond Raw
TURBIDITY	0.5	0.1	0.2	0.1	3.9	0.8	1.7	1.7	1.5	1.6	0.4	0.1	1.2
SEDIMENT	0	0	0	0	0	0	0	0	0	0	0	0	0
COLOR	28	10	10	5	65	25	96	28	100	10	5	5	70
ODOR	0	0	0	0	0	0	0	0	0	0	0	0	
pH	6.2	8.5	5.9	7.5	6.4	6.2	6.0	7.3	6.8	5.7	9.0	6.6	6.6
ALKALINITY-TOTAL	23	38	14	88	31	22	4	9	27	3	16	53	5
HARDNESS (CaCO3)	46	69	93	56	49	61	13	48	37	11	66	74	18
CALCIUM (Ca)	11	19	26	16	13	17	3.9	17	11	2.5	23	20	4.5
MAGNESIUM (Mg)	4.3	5.1	6.9	4.0	3.9	4.5	0.8	1.2	2.3	1.2	1.9	8.3	1.7
SODIUM (Na)	27	82	120	63	35	66	7.3	7.5	20.	9.1	14	23	13
POTASSIUM (K)	1.8	4.9	4.6	1.0	1.4	2.6	0.4	0.7	1.6	0.5	0.2	1.1	0.02
IRON (Fe)	0.21	0.04	0.10	0.04	1.2	0.25	0.21	0.06	0.47	0.43	0.04	0.04	0.21
MANGANESE	2.0	0.03	2.6	0.42	2.5	2.7	0.07	0.09	0.13	0.10	0.03	0.03	0.03
SULFATE (SO4)	17	19	23	23	17	18	13	30	77	10	36	21	13
CHLORIDE (Cl)	60	125	245	62	60	125	15	15	45	13	24	39	22
SPEC. COND.(u/cm)	286	235	886	420	302	511	83	145	220	75	193	286	109
NITROGEN (AMMONIA)	0.08	0.02	0.17	0.02	0.21	0.11	0.02	0.02	0.02	0.02	0.02	0.02	0.02
NITROGEN (NITRATE)	0.3	1.0	2.9	0.5	0.2	1.1	0.1	0.1	0.4	0.1	0.1	3.3	0.1
NITROGEN (NITRITE)	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.004	0.002	0.002	0.002	0.002
COPPER (Cu)	0.06	0.03	0.23	0.03	0.03	0.10	0.06	0.03	0.04	0.03	0.03	0.03	0.03

	Hanover									Pembroke	
	Tindale Tap	Hanover St. #1	Hanover St. #2	Tindale St. #1	Tindale St. #2	Pond St. #2	Pond St. #3	Inf. to W.T.P.	Finish W.T.P.	Center St.	School St.
TURBIOITY	0.2	0.4	3.8	0.3	1.0	0.9	0.3	0.5	0.2	0.5	1.1
SEOIMENT	0	0	0	0	0	0	0	0	0	0	0
COLOR	6	32	70	2	120	34	63	50	4	21	14
ODOR	0	0	0	0	0	0	0	0	0	0	0
pH	6.0	5.9	5.8	6.1	6.1	6.0	5.7	5.9	7.0	6.2	6.0
ALKALINITY-TOTAL	20	15	18	20	33	11	8	9	39	18	14
HARDNESS (CaCO3)	43	38	38	38	57	40	37	38	103	30	27
CALCIUM (Ca)	10	10	10	9.5	13	9.0	8.2	8.8	34	6.9	5.8
MAGNESIUM (Mg)	4.3	3.1	3.1	3.5	5.7	4.2	3.8	3.9	4.4	3.1	2.9
SODIUM (Na)	23	53	12	16	21	42	42	40	38	14	13
POTASSIUM (K)	1.2	1.5	0.7	1.1	1.6	1.4	1.2	1.2	1.3	0.9	0.7
IRON (Fe)	0.04	0.04	0.55	0.11	4.8	0.17	0.10	.15	.04	0.10	0.11
MANGANESE (Mn)	0.03	0.03	0.43	0.03	0.46	0.06	0.04	.06	0.03	0.06	0.03
SULFATE (SO4)	17	14	24	16	17	15	14	14	56	12	10
CHLORIOE (Cl)	34	55	18	36	38	70	70	71	73	25	23
SPEC. COND. (u/cm)	216	262	145	169	238	289	271	276	411	147	
NITROGEN (AMMONIA)	0.02	0.02	0.02	0.02	0.08	0.03	0.02	0.02	0.02	0.02	2
NITROGEN (NITRATE)	3.0	1.5	0.2	1.0	0.1	0.2	0.3	0.3	0.2	1.0	0.8
NITROGEN (NITRITE)	0.002	0.002	0.003	0.002	0.014	0.002	0.002	0.002	0.002	0.002	0.002
COPPER (Cu)	0.06	0.36	0.03	0.03	0.26	0.03	0.3	0.2	0.17	0.17	1.5

	Hingham/Hull									Hanson	
	Accord Brook Outlet	Fulling Mill T.P.	Free St. St. #2 Raw	Free St. #3	Free St. #2 Fin.	Downing Street	Accord Pond Raw	Scotland Street	Prospect Street	Crystal Spring Well	Wellfield
TURBIDITY	0.8	0.8	0.4	0.4	0.2	0.3	0.9	0.2	0.2	0.3	0.3
SEDIMENT	0	0	0	0	0	0	0	0	0	0	0
COLOR	130	27	55	0	45	2	22	10	7	0	2
ODOR	0	0	0	0	0	0	0	0	0	0	0
pH	6.1	7.9	6.6	6.3	6.5	7.7	6.5	6.3	6.5	6.5	6.4
ALKALINITY-TOTAL	6	53	44	26	40	86	6	28	40	26	13
HARDNESS	23	53	65	64	67	155	18	59	51	49	34
CALCIUM (Ca)	5.8	18	19	18	20	49	4.7	13	13	12	7.8
MAGNESIUM (Mg)	1.9	2.0	4.1	4.6	4.1	7.8	1.4	6.4	4.5	4.7	3.5
SODIUM (Na)	15	17	13	19	15	16	25	14	9.9	25	12
POTASSIUM (K)	0.7	0.6	1.7	2.2	2.1	0.8	0.7	1.0	0.7	2.7	0.7
IRON (Fe)	0.25	0.15	0.10	0.04	0.04	0.04	0.13	0.10	0.04	0.05	0.00
MANGANESE (Mn)	0.03	0.12	0.73	0.03	0.03	0.09	0.09	0.17	0.03	0.03	0.02
SULFATE (SO_4)	10	12	23	24	18	14	11	21	12	28	23
FLORIDE	34	26	24	27	25	28	45	29	13	36	23
SPEC. COND. (u/cm)	151	209	213	231	218	357	194	222	165	228	142
NITROGEN (AMMONIA)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
NITROGEN (NITRATE)	0.2	0.3	0.4	4.1	0.4	2.2	0.2	0.9	0.5	0.3	0.1
NITROGEN (NITRITE)	0.002	0.002	0.008	0.002	0.002	0.074	0.003	0.003	0.002	0.003	0.002
COPPER (Cu)	0.05	0.03	0.04	0.03	0.003	0.11	0.03	0.03	0.03	0.01	0.01

	Hopkinton			Hopkinton			Hopkinton		Scituate				
	South St. West	Grove St. #2 Raw	Grove St. #3	Ridge Hill Rd.	Grove St. #5	South St. East	Washington St. #7	Washington St. #8	Old Bucket Raw	Oaken Pond Fin.	Boston Sand & Gravel	Edison Station	Barnes Meadow
TURBIDITY	0.6	0.1	0.6	0.0	0.0	0.6	0.0	0.1	1.8	0.2	0.1	0.1	0.1
SEDIMENT	0	0	0	0	0	0	0	0	0	0	0	0	0
COLOR	5	0	5	5	0	40	40	0	200	13	5	3	0
ODOR	0	0	0	0	0	0	0	0	0	0	0	0	0
pH	6.0	6.4	5.8	5.9	5.9	6.0	5.7	5.9	6.4	7.2	6.3	6.4	6.5
ALKALINITY-TOTAL	17	16	8	12	10	13	15	10	17	20	20	20	20
HARDNESS (CaCO3)	32	32	22	71	35	25	49	52	22	21	31	78	36
CALCIUM (Ca)	8.2	8.0	5.7	18	8.7	6.7	13	13	5.1	6.6	18	8.3	
MAGNESIUM (Mg)	2.8	2.9	1.9	6.3	3.1	1.9	4.0	4.6	2.1	1.6	3.3	8.1	3.7
SODIUM (Na)	75.	9.1	16	43	21	21	47	66	20	44	13	27	21
POTASSIUM (K)	1.4	0.5	0.6	1.2	0.8	0.7	1.4	1.3	1.4	1.4	0.4	1.0	0.5
IRON (FE)	0.04	0.04	0.05	0.04	0.04	0.23	0.04	0.04	1.9	0.04	0.04	0.04	0.04
MANGANESE (Mn)	0.03	0.03	0.03	0.03	0.03	0.21	0.03	0.03	0.05	.05	0.03	0.03	0.03
SULFATE (SO4)	16	13	13	20	18	15	17	16	11	27	13	20	15
CHLORIDE (Cl)	100	17	34	68	33	29	57	91	36	40	22	70	44
SPEC. COND. (u/cm)	363	121	138	325	178	158	282	390	156	245	140	323	221
NITROGEN (AMMONIA)	0.02	0.02	0.02	0.2	0.02	0.02	0.02	0.02	0.08	0.02	0.02	0.02	0.02
NITROGEN (NITRATE)	0.5	0.3	1.1	3.6	1.6	0.1	2.5	1.8	0.1	0.1	0.2	1.42	0.7
NITROGEN (NITRITE)	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.000	0.002	0.002	0.002	0.00
COPPER (Cu)	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

APPENDIX C
Bylaws and Regulations

1. Water Resources Protection District
2. Subdivision Regulation Amendments
3. Registration of Underground Storage Tanks
4. Hazardous Materials By-Law
5. Earth Removal Bylaw Amendment

WATER RESOURCES PROTECTION DISTRICT

1. Purpose of District

The purpose of this Water Resources Protection District is:

A. to promote the health, safety, and general welfare of the community;

B. to protect, preserve and maintain the existing and potential groundwater supply and groundwater recharge areas within the town;

C. to preserve and protect present and potential sources of water supply for the public health and safety;

D. to conserve the natural resources of the town;

E. to prevent blight and the pollution of the environment.

2. Scope of Authority

The Water Resources Protection District is considered as overlying other zoning districts. No uses not permitted in the portions of the districts so overlaid shall be permitted in this district.

3. Definitions

Animal Feedlot: A plot of land on which 25 livestock or more per acre are kept for the purposes of feeding.

Aquifer: Geologic formation composed of rock or sand and gravel that contains significant amounts of potentially recoverable potable water.

Groundwater: All the water found beneath the surface of the ground. In this bylaw the term refers to the slowly moving subsurface water present in aquifers and recharge areas.

Impervious Surface: Material on the ground that does not allow surface water to penetrate into the soil.

Leachable Wastes: Waste materials including solid wastes, sewage, sludge, and agriculture wastes that are capable of releasing water-borne contaminants to the surrounding environment.

Mining of Land: The removal or relocation of geologic materials such as topsoil, sand and gravel, metallic ores, or bedrock.

Recharge Areas: Areas composed of permeable stratified sand and gravel and certain wetlands that collect precipitation or surface water and carry it to aquifers.

Solid Wastes: Useless, unwanted, or discarded solid material with insufficient liquid content to be free flowing. This includes but is not limited to rubbish, garbage, scrap materials, junk, refuse, inert fill material and landscape refuse.

4. Establishment and Delineation of Water Resources Protection District

For the purposes of this district, there are hereby established within the town certain aquifer protection areas, consisting of aquifers and/or aquifer recharge areas, which are delineated on a map at a scale of 1 inch to ___ feet entitled "Water Resources Protection Areas, Town of _____" This map is hereby made a part of this district and of the town zoning bylaw and is on file in the Office of the Town Clerk.

Where the bounds are delineated are in doubt or in dispute, the burden of proof shall be upon the owner(s) of the land in question to show where they should properly be located. At the request of the owner(s) the town may engage a professional geologist or soil scientist to determine more accurately the location and extent of an aquifer or recharge area, and may charge the owner(s) for all or part of the cost of the investigation.

5. Use Regulations

Within the Water Resources Protection District the following regulations shall apply:

A. The following uses are permitted within the Water Resources Protection District,, subject to s. B, provided that all necessary permits, orders, or approvals required by local, state, or federal law are also obtained:

(i) conservation of soil, water, plants and wildlife;

(ii) outdoor recreation, nature study, boating, fishing, and hunting where otherwise legally permitted;

(iii) foot, bicycle and/or horse paths and bridges;

(iv) normal operation and maintenance of existing water bodies and dams, splash boards, and other water control, supply and conservation devices;

(v) maintenance, repair and enlargement of any existing structure provided there is no increase in impermeable pavement;

(vi) residential development, if permitted in the underlying district, provided that no more than 15 percent of a building lot (including the portion of any new street abutting the lot) is rendered impervious.

(vii) farming, gardening, nursery, conservation, forestry, harvesting and grazing provided that fertilizers, herbicides, pesticides, manure and other leachable materials are not stored outdoors.

B. The following uses are prohibited:

(i) disposal of solid wastes, other than brush and stumps;

(ii) storage of petroleum or other refined petroleum product except within buildings which it will heat;

(iii) the disposal of liquid or leachable wastes, except residential waste disposal systems;

(iv) the rendering impervious of more than 15% of any lot;

(v) industrial uses which discharge process wastewater on-site;

(vi) storage of road salt or other deicing chemicals;

(vii) dumping of snow containing deicing chemicals which is brought in from outside the district;

(viii) animal feedlots;

(ix) the storage of uncovered manure;

(x) mining of land except as incidental to a permitted use;

(xi) the storage or disposal of hazardous wastes, as defined by the Hazardous Waste Regulations promulgated by the Hazardous Waste Board, the Water Resources Commission, and the Division of Water Pollution Control under the provisions of Sections 27 (8), 52, 57, and 58 of Chapter 21 of the General Laws.

(xii) Automotive service and repair shops, junk and salvage yards.

C. The following uses are permitted by Special Permit, subject to the approval of the Zoning Board of Appeals under such conditions as they may require and also subject to s. B:

(i) the application of pesticides for non-domestic or non-agricultural uses provided that all necessary precautions shall be taken to prevent hazardous concentrations of pesticides in the water and on the land within the Aquifer Protection District as a result of such application. Such precautions include, but are not limited

to, erosion control techniques, the control of runoff water (or the use of pesticides having low solubility in water), the prevention of volatilization and redeposition of pesticides and the lateral displacement (i.e. wind drift) of pesticides;

(ii) the application of fertilizers for non-domestic or non-agricultural uses provided that such application shall be made in such a manner as to minimize adverse impacts on surface and groundwater due to nutrient transport and deposition and sedimentation;

(iii) those commercial and industrial activities permitted in the underlying district with a site plan review to prevent compaction and siltation, loss of recharge, exfiltration for sewer pipes and contamination by oil, chemicals, nutrients, etc.

D. Procedures for Issuance of Special Permit

1. Each application for a special permit shall be filed with the Zoning Board of Appeals and shall be accompanied by _____ copies of the plan.

2. Said application and plan shall be prepared in accordance with the data requirements of the proposed development, (e.g., site plan review, erosion and sedimentation control plan, etc.)

3. The Zoning Board of Appeals shall refer copies of the application to the Board of Health, Planning Board, the Conservation Commission and Town Engineer/Department of Public Works, which shall review, either jointly or separately, the application and shall submit their recommendations to the Zoning Board of Appeals. Failure to make recommendations within 35 days of the referral of the application shall be deemed lack of opposition.

4. The Zoning Board of Appeals shall hold a hearing, in conformity with the provisions of G.L. ch. 40A, s. 9, within 65 days after the filing of the application and after the review by the town/boards/departments.

Notice of the public hearing shall be given by publication and posting and by first-class mailings to "parties in interest" as defined in G.L. ch. 40A, s. 11. The decision of the Zoning Board of Appeals and any extension, modification or renewal thereof, shall be filed with the Zoning Board of Appeals and Town Clerk within 90 days following the closing of the public hearing. Failure of the special permit granting authority to act within 90 days shall be deemed as a granting of the permit. However, no work shall commence until a certification is recorded as required by said s.11.

5. After notice and public hearing, and after due consideration of the reports and recommendations of the boards/departments, the Zoning Board of Appeals may grant such a special permit provided that it finds that the proposed use:

   (a) is consistent with the purpose and intent of this bylaw and will promote the purposes of the Water Resources Protection District,

   (b) is appropriate to the natural topography, soils, and other characteristics of the site to be developed;

   (c) will not, during construction or thereafter, have an adverse environmental impact on the aquifer or recharge area; and

   (d) will not adversely affect an existing or potential water supply.

Subdivision Regulation Amendments

Preliminary Plan

The Board may require that the following be submitted where such information is necessary to evaluate the plan because of special circumstances of the proposal or its location including, but not limited to, proximity to aquifers, groundwater recharge areas, or public water supply wells:

a. Location of aquifers or recharge areas for existing or potential drinking water supplies.

b. Maximum groundwater table elevation and direction and velocity of groundwater flow.

c. Projection of nutrient loading (nitrate-nitrogen concentrations) in groundwater downgradient of the subdivision in the water resources protection district.

d. Analysis of open and closed drainage system alternatives, examining effects upon the recharge of aquifers and the quality of the groundwater.

Required Improvements

The Board may require that the following measures be taken because of special circumstances of the proposal or its location including, but not limited to, proximity to aquifers, groundwater recharge areas, or public water supply wells:

(1) Design and construction shall reduce, to the extent possible, the following:

- dimensions of paved areas
- encroachment within any wetland or floodplain
- volume of cut and fill
- area over which vegetation will be distributed
- extent of waterways altered or relocated

(2) Pollution control devices, including provisions for contaiminant removal employing detention basins subsurface drains or perforated risers, oil and grit separator catch basins, and other appropriate devices.

(3) Measures to restrict nutrient loading in down gradient groundwater to a maximum of five milligrams per liter (5 mgl) nitrate-nitrogen.

Registration of Underground Storage Tanks

Article : Will the Town vote to amend the General Bylaws by adding thereto the following new bylaw:

From after January 1, 1989, any person who owns, leases, or otherwise controls any parcel of land wherein an underground storage tank or container has been or will be installed shall register such tank or container with the Fire Chief.

As part of the registration process such person shall furnish to the Fire Chief evidence, deemed sufficient by him, to establish the date of installation of said tank or container. If such evidence is not furnished the tank or container shall be presumed to have been installed twenty years prior to the effective date of this bylaw. Tanks which are not registered as provided herein shall be tested immediately upon discovery at the owner's expense. The method of testing must be approved in advance by the Fire Chief.

HAZARDOUS MATERIALS BY-LAW

SECTION 1: HAZARDOUS MATERIALS

SUBSECTION 1: AUTHORITY

This By-Law is adopted by the Town of Canton under its home-rule powers, its police powers to protect the public health and welfare, and its authorization under Massachusetts General Laws, Chapter 40, Section 21.

SUBSECTION 2: PURPOSE

This By-Law is intended to protect the public health, safety and welfare, and the environment; as well as preserve and maintain the existing and potential groundwater supply, groundwater recharge areas, and surface waters within the Town from contamination with hazardous materials.

SUBSECTION 3: DEFINITIONS

The following definitions shall apply in the interpretation and implementation of this By-Law.

Hazardous Materials means a product or waste or combination of substances which because of quantity, concentration, or physical or chemical, or infectious characteristics may reasonably pose, in the determination of the enforcing authority, a substantial present or potential hazard to the human health, safety, or welfare, or the environment when improperly treated, stored, transported, used or disposed of, or otherwise managed. Any substance which may create a special hazard in the event of a spill, leak, fire, or exposure; and all substances deemed a hazardous waste in Massachusetts General Laws, Chapter 21C shall also be considered a hazardous material for the purpose of the By-Law.

Contingency Plan means a document setting an organized planned, and coordinated course of action to be followed in case of fire, explosion, or release of hazardous materials which could threaten public health, safety, or welfare, or the environment.

Discharge means the disposal, deposit, injection, dumping, spilling, leaking, incineration, or placing of any hazardous material into or on any land or water so that such hazardous material or any constituent thereof may enter the environment

SUBSECTION 3: DEFINITIONS CONTINUED

Materials Safety Data Sheet means the form containing data on physical characteristics, flammability, explosivity, reactivity, and the health and safety hazards of specific chemicals, as well as information relative to procedures recommended for spills and leaks of specific chemicals and special protections and precautions to be taken in the handling of specific chemicals.

Reportable Discharge means all discharge greater than three gallons liquid volume or five pounds dry weight, or any discharge which would potentially threaten the public health and safety or the environment by entering surface water, groundwaters, or water recharge areas, or by emitting toxic fumes or gases into the air. Discharges which are in compliance with all Federal, State, and local regulations, or which are permitted by governing Federal, State, or local agencies are not considered reportable discharges.

SUBSCETION 4: SEVERABILITY

Each provision of this By-Law shall be construed as separate to the end, that if any provision, or sentence, clause or phrase thereof, shall be held invalid for any reason, the remainder of that section and all other sections shall continue in full force and effect.

SUBSECTION 5: HAZARDOUS MATERIALS NOT SUBJECT TO REGULATION BY THIS BY-LAW

The following materials are not within the scope of authority of this By-Law:

(1) Domestic Sewage
(2) Household waste including garbage, trash and septage from single and multiple residences, hotels and motels.
(3) Wastes generated from the growing of agricultural crops and the raising of animals, including manure which are returned to the soil as fertilizer.

SUBSECTION 6: REGISTRATION REQUIREMENTS

Every owner, or operator of a commercial or industrial establishment (including municipal, state, and federal operations) which stores, transports, uses, handles, or otherwise manages hazardous materials (excluding fuel oil stored for the purpose of heating buildings located on site) totaling more than fifty gallons liquid volume or twenty-five pounds dry weight shall register with the Board of Health.

SUBSECTION 6: CONTINUED

Registration includes the following:

(1) Submission of a map or written description locating areas where hazardous materials are stored, handled, or in use, specifying approximate average quantities of materials in each location and the special handling required in a fire, leak, spill or exposure. Areas must also be identified which store emergency equipment including medical supplies, along with a brief description of the capabilities of the equipment.

This map or written description must also be posted in one of the following on site locations: (a) Guard Shack, (b) Fire Alarm Box, (c) Sprinkler Riser, (d) other location acceptable to the Head of the Fire Department. The location of this posting must be specified during registration.

(2) Submission of names, addresses, and telephone numbers of all qualified "Emergency Coordinators" who are individuals identified by owners or operators of commercial or industrial establishments which must register in accordance with this By-Law "Emergency Coordinators" must be knowledgeable in the types of hazardous materials used at the establishment, proper storage and handling of those materials, familiar with the establishments emergency contingency plan, and authorized as on-site coordinator in the event of an emergency.

(3) Keep on file at all times in an on-site location known and accessible to all "Emergency Coordinators", Materials Safety Data Sheets on all hazardous materials manufactured, stored, or used at the establishment. These Materials Safety Data Sheets must be available to the Board of Health and the Head of the Fire Department during routine inspections, investigations, and in the event of an emergency.

(4) Keep on file at all times in an on-site location known and accessible to all "Emergency Coordinators" an Emergency Contingency Plan which identifies "Emergency Coordinators" and details the area where and ways in which an emergency could come about, the techniques and procedures to be used for prevention and control of such emergencies, the emergency equipment availabl on-site, outside agencies and organizations who should be notifie and/or may provide services in an emergency, an evacuation plan for personnel, and an inventory of the types, approximate quantities, and method of storage, transportation, and disposal of all hazardous materials.

SUBSECTION 6.1 EFFECTIVE DATE OF REGISTRATION REQUIREMENTS

(A) Registration required by Section 6 shall be initially submitted by September 1, 1983 and annually thereafter within thirty days of January 1 each year. Records required in Subsection to be kept on file at each establishment should be updated as frequently as necessary to ensure proper handling of hazardous materials and adequate procedures to minimize emergencies and the damage which would result from such emergencies.

(B) Owners and operators of commercial and industrial establishments who have not previously registered in accordance with Subsection 6 shall, if they meet registration requirements register initially within thirty days of meeting such requirements and thereafter within thirty days of January 1 each year.

SUBSECTION 6.2 UPDATING OF REGISTRATION INFORMATION

All information required under Subsection 6 of this By-Law must be kept current to reflect substantial changes in quantities or types of hazardous materials on-site.

SUBSECTION 7: HAZARDOUS MATERIALS GENERALLY

All hazardous materials within the Town of Canton must be stored, handled, transported and used in such a way as to minimize discharges and to ensure maximum protection of the environment and the public health, safety and welfare.

SUBSECTION 7.1:

All commercial and industrial establishments (including municipal, state, and federal operations) must provide adequate employee training programs to ensure proper use, storage, transportation and handling of hazardous materials.

SUBSECTION 7.2

Owners and operators of establishments registered in accordance with Subsection 6 of this By-Law must keep sufficient records to detect significant loss of hazardous materials and provide best estimates of quantities of hazardous materials on-site.

SUBSECTION 7.3

All locations where hazardous materials are stored or used in quantities that could cause a substantial hazard in the event of a spill, leak, fire, or exposure, shall be designated with legible warning signs of bright yellow, or other equally conspicuous --lor, indicating the potential danger and how to overcome or avoid such danger.

SUBSECTION 7.4

All hazardous materials shall be held in product tight containers. All containers of hazardous materials which permit leakage or spillage shall be disposed of or repaired to its original product tight state.

SUBSECTION 7.5

Every owner of a commercial or industrial establishment (including municipal, state, or federal operations) shall comply with all Federal, State, and Municipal Laws and Regulations relative to Hazardous Materials.

SUBSECTION 8: ABOVEGROUND STORAGE OF HAZARDOUS MATERIALS

(A) Aboveground containers of hazardous materials shall be kept in an orderly manner, shall be adequately marked to identify the hazard, and shall be stored on a surface impervious to the material being stored. The storage area shall be enclosed by a permanent dike of impermeable construction. The volume of the area enclosed by the dike shall be equal to or greater than the capacity of the containers within the dike.

(B) There shall be no storage of incompatible chemicals (those which react with one another to create a special hazard) in the same area.

(C) Drainage and ventilation of storage areas containing hazardous materials shall be constructed and maintained so as to control spills, fumes, noxious gases and other potential sources of contamination

SUBSECTION 9: UNDERGROUND STORAGE

The following provisions shall apply to all underground liquid hazardous material storage systems.

SUBSECTION 9.1

Owners shall file with the Board of Health the size, type, age(if known), and location of each tank, and the type of hazardous materials stored in each, on or before September 1, 1983.

SUBSECTION 9.2

Owners of tanks for which evidence of installation is not available shall, at the order of the Board of Health, have such tanks tested. If either the Board of Health or the Head of the Fire Department determines that the tank is not product tight

SUBSECTION 9: CONTINUED

it shall be repaired or disposed of under the direction of the Board of Health or the Head of the Fire Department.

SUBSECTION 9.3

All tanks shall be tested the day of installation and thereafter at intervals sufficient to prevent loss of hazardous materials and resulting contamination.

SUBSECTION 9.4

All newly installed tanks subject to this By-law shall be protected from internal and external corrosion and shall be of a design approved by the Board of Health and the Head of the Fire Department.

SUBSECTION 9.5

All leaking tanks must be emptied by the owner or operator within twelve hours of leak detection; and repaired to a product tight condition or removed by the owner or operator in a time period to be determined by the Board of Health.

SUBSECTION 10: EFFECTIVE DATE

All storage provisions contained in Subsections 7, 8 and 9 must be complied with by July 1, 1984.

SUBSECTION 11: REPORTING REQUIREMENTS

Any person having knowledge of a reportable discharge of hazardous material shall immediately report the discharge to the Board of Health, and if involving falmmable or explosive materials, to the Head of the Fire Department.

SUBSECTION 12: PROTECTION OF PUBLIC WATER SUPPLIES

In order to protect and preserve existing drinking water sources, the following uses are prohibited within one thousand (1,000) feet of the head of a gravel packed well used as a source of municipal drinking water unless exempted by a variance in accordance with Subsection 14 of this By-Law.

SUBSECTION 12: CONTINUED

A. Automotive service and repair shops, junk and salvage yards, and car washes.

B. Storage of road salts or other deicing chemicals

C. Use of chemicals for deicing unless deemed necessary for public safety.

D. The discharge of hazardous materials.

E. Commercial or industrial uses which require registration in accordance with Subsection 6 of this By-Law.

F. Commercial or industrial uses which discharge process wastewaters on-site, excluding discharges permitted in accordance with all applicable State and Federal regulations which are shown to contain no contaminants.

G. Commercial or industrial uses which re-charge stormwater to groundwater without passage through oil and grease traps and sediment traps, constructed, operated, and maintained to minimize groundwater contamination.

SUBSECTION 13: PERMITS REQUIRED

A. A permit shall be required and obtained from the Board of Health for all new commercial or industrial establishments requiring registration in accordance with Subsection 6.2, prior to the operation of said establishment, to determine that the provisions of this By-Law have been met.

B. A permit shall also be required and obtained from the Board of Health for all establishments requiring registration in accordance with Subsection 6, who seek to install additional aboveground or underground hazardous materials storage tanks.

SUBSECTION 14: VARIANCES

The Board of Health may vary the application of any provision of this By-Law, unless otherwise required by law, in any case when, in its opinion, the applicant has demonstrated that an equivalent degree of environmental protection required under this By-Law will still be achieved. The applicant at his own expense must notify all abutters by certified mail at least ten days before the Board of Health meeting at which the variance request will be considered. The notification shall state the variance sought and the reasons thereof. Any variance granted by the Board of Health shall be in writing. Any denial of a variance shall also be in writing and shall contain a brief statement

EARTH REMOVAL BYLAW AMENDMENT

Excavation shall be restricted to those areas which are at elevations ten feet or more above the maximum groundwater elevation as determined by the most recent testing conducted under the provisions of this section.

No permit shall be issued or renewed under this Bylaw until the applicant has submitted to the Board current and complete information on the actual and proposed depth of excavation and the maximum groundwater elevation throughout the entire area proposed to be excavated. Maximum groundwater elevation shall be determined by means of monitoring wells, test pits and soil borings during the months of March, April or May. Such tests shall be conducted by a Massachusetts Registered Professional Engineer at the expense of the applicant and shall be observed by a representative of the Board. Test results shall be submitted to the Board over the engineer's stamp.

The groundwater monitoring wells shall be left in place during the period that the applicant holds a permit hereunder, and readings therefrom shall be taken during March, April or May of each year. The results of such readings shall be submitted to the Board over the engineer's stamp.

APPENDIX D

Funding and Technical Assistance Sources

There are a number of programs administered by state agencies under the Executive Office of Environmental Affairs that provide support for water supply protection measures. Technical assistance is available as well as grant monies allocated for land acquisition programs and technical services. Below is a brief summary of some of these programs, including a contact for further information.

* DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Household Hazardous Wastes Collection

The Department of Environmental Management's Office of Safe Waste Management can assist communities with education about household hazardous wastes and suggest alternative products to decrease the amount of hazardous wastes being used and ultimately disposed of by households. DEM staff can also help organize local collection and disposal efforts. Under Chapter 584, section 47, matching grant funds were made available in FY'87 and FY'88 through the Office of Safe Waste Management for collection, transportation and disposal of household hazardous wastes. More than 100 communities have held collections to date. Funds for future grants are pending.

Contact: Cassandra Goldwater
DEM, Office of Safe Waste Management
100 Cambridge Street, Boston, MA 02202
727-3260

* DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING, DIVISION OF WATER SUPPLY

Aquifer Land Acquisition

The Aquifer Land Acquisition Program (ALA) provides financial assistance to communities to purchase land or easements to protect the recharge areas of water supply wells and/or surface drinking water supplies. A 20% match is required from grantees. In order to be eligible for funds, communities must have delineated Zones I, II and III around their water supply wells. Purchase of lands in the Zone II area are eligible for reimbursement under ALA if all other criteria of the program are met. Applications receiving the most favorable review are from communities who have already demonstrated a commitment to water supply protection through land holdings that protect water supply, land uses compatible with water protection, and land use controls such as water supply overlay protection districts or related restrictive zoning. ALA funds may be used to finance further studies of Zone II (approximately 10% of grant award) and to acquire land in fee by outright purchase, or to acquire future development rights of land through the use of conservation restrictions.

Contact: Mike Stroman, Aquifer Land Acquisition Program Manager
DEQE, Division of Water Supply
One Winter Street, Boston, MA 02108
292-5526

Groundwater Technical Assistance

The Groundwater Technical Assistance Program within the Division of Water Supply is set up to offer a variety of technical, planning and educational programs to enable communities to increase their knowledge and protection of water supplies. There are five main programs available.

1. Technical Assistance. Includes technical review of groundwater studies and reports, advice on development and implementation of groundwater protection bylaws and regulations.

2. Water Supply Protection Atlas. Provides statewide environmental data in the form of transparent overlays for USGS quadrangles. This enables communities to associate water supplies with geologic information and possible sources of contamination.

3. Local Bylaws and Regulations File. Provides a summary of existing and proposed bylaws and regulations by community and some model bylaws for review and comparison.

4. Groundwater Slide Tape Programs. DEQE has slide-tape programs about groundwater movement, contamination, and protection techniques, and underground storage concerns.

5. publications. General groundwater information is available in a bimonthly newsletter and the agency also has a series of handbooks discussing various aspects of groundwater and groundwater protection.

Contact: Mike Rapacz
DEQE, Division of Water Supply
One Winter Street, Boston, MA 02108
292-5952

Leak Detection and System Rehabilitation

This program provides financial assistance to public water suppliers to conduct water audit projects and leak detection surveys, and for rehabilitation and replacement work on existing water distribution systems. Such work may include: cleaning and lining or replacing water mains, replacing appurtenances, system looping, or covering finished water storage tanks when ordered by DEQE or DPH. Grants are awarded for projects conducted on publicly owned water systems on a 50% reimbursement basis. Any public entity that owns and operates a public water supply system is eligible.

Contact: Jack Hamm, Program Director, Construction Grants Program
DEQE, Division of Water Supply
One Winter Street, Boston, MA 02108
556-1080

Meter Modernization

This program provides financial assistance for replacement work or rehabilitation work on the public water metering system. Such work may include new meter installation, modernization, rehabilitation, or centralized utility metering. Grants are awarded for projects conducted on publicly owned water systems on a 50% reimbursement basis. Any public entity that owns and operates a public water supply system is eligible.

Contact: Jack Hamm, Program Director, Construction Grants Program
DEQE, Division of Water Supply
One Winter Street, Boston, MA 02108
556-1080

Water Filtration

This program provides financial assistance for the construction of drinking water filtration facilities. Grants are awarded for projects conducted on publicly owned water systems on a 50% reimbursement basis. Any public entity that owns and operates a public water supply system is eligible.

Contact: Jack Hamm, Program Director, Construction Grants Program
DEQE, Division of Water Supply
One Winter Street, Boston, MA 02108
556-1080

DIVISION OF WATER POLLUTION CONTROL

Construction Grants

This program provides financial assistance for the design and construction of wastewater treatment facilities. Project costs are shared with 35% from federal funding, 55% from state funding, and 10% from local funding.

Contact: Paul Taurasi
DEQE, Division of Water Pollution Control
One Winter Street, Boston, MA 02108
292-5739

Tier II Construction Grants

This program provides state funding for 70% of construction costs for communities with projects that did not rank high enough to receive federal wastewater treatment plant funding.

Contact: Allen Slater
DEQE, Division of Water Pollution Control
One Winter Street, Boston, MA 02108
292-5749

Collection Sewers

This program provides financial assistance for the construction of new collection sewers. Grants fund up tp 50% of eligible construction costs to a maximum of $3 million.

Contact: Leo Andronico
DEQE, Division of Water Pollution Control
One Winter Street, Boston, MA 02108
292-5681

Infiltration and Inflow

This program provides financial assistance to correct problems of infiltration and inflow (I/I). Grant awards cover up to 90% of the cost of conducting an I/I source study and the construction work to upgrade the water supply system. Infiltration occurs when clean water leaks into sewerage systems through defective pipes and connections. Inflow occurs when clean water enters the sewerage system via storm drain interconnections or illegal sump pumps or downspout connections from private homes. Reducing I/I will reduce the unnecessary flow of clean water to wastewater treatment plants.

Contact: Jim Courchaine
DEQE, Division of Water Pollution Control
One Winter Street, Boston, MA 02108
292-5728

DIVISION OF SOLID WASTE

Landfill Capping Grants

This program provides financial assistance to municipalities for the closure of municipal landfills in an environmentally sound manner.

Contact: Larry Galkowski
DEQE, Division of Solid Waste
One Winter Street, Boston, MA 02108
292-5973

Comprehensive Landfill Assessment and Clean Up Program

This is a new program funded through the new Solid Waste Act. One hundred million dollars has been appropriated to study the approximately 700 active and inactive landfill sites in the Commonwealth for possible groundwater contamination. These sites will qualify under the Solid Waste Act (Chapter 584) for funding to conduct hydrogeological and remedial action feasibility studies. Grant awards provide 90% of the project costs, supplemented by a 10% loan to the grantee.

Contact: Joseph Selle
dEQE, Division of Solid Waste
One Winter Street, Boston, MA 02108
292-5970

* DIVISION OF CONSERVATION SERVICES

Self-Help

This program provides grants to municipalities for land acquisition to preserve open space for conservation and passive recreation. State funding is available to cover between 63-90% of the land costs, based on a municipality's per capita equivalent. Eligibility requirements include an established conservation commission and an approved open space/conservation and/or recreation plan.

Contact: Joel Lerner
Division of conservation Services
100 Cambridge Street, 20th fl., Boston, MA 02202
727-1552

APPENDIX E

SOUTH SHORE WATER SUPPLY PROTECTION ADVISORY COMMITTEE

Meomorandum of Understanding

WHEREAS THE Towns of Cohasset and Weymouth in Norfolk County and the towns of Duxbury, Hanover, Hingham, Hull, Norwell, Marshfield, Rockland, and Scituate in Plymouth County, Massachusetts have certain natual resources of surface and underground waters, streams, water courses, and watersheds within the common areas of the ten towns; and within the several towns certain ponds, lakes, reservoirs, storage basins and wells now used or with a potential use as sources of water supply, and

WHEREAS the ten towns have a common interest in protecting such natural resources to ensure the availability of water in such quality and quantity as necessary to meet the present and future needs of the inhabitants of the ten towns,

NOW, THEREFORE, the signatories of this memorandum of understanding representing the towns agree as follows:

1. To consult together, cooperate and act jointly in matters pertaining to natural resources of wetlands, surface and underground waters within the boundaries of the ten towns.

2. To consult together and make recommendations relative to zoning and general by-laws which may effect such resources, adopted by the ten towns under the independent home rule authority of the several towns.

3. To consult together and make recommendations relative to the adoption and promulgation of rules and regulations of the several town boards whose official duties concern the use of land, the protection of natural resources, and the present and potential sources of water supply.

4. To work together as a mechanism for joint local action for the resolution of water quality and water resource issues.

It is further agreed that it is the intent of this memorandum of understanding that local action and implementation of local powers shall be utilized to the fullest extent. For the purpose of providing public information and advice on matters pertaining to the protection of water resources, this association of signatories may be referred to as the Water Supply Protection Advisory Committee. The membership of the committee shall be comprised of one representative and one alternate from each participating town, to be certified in writing by the respective appointing authorities. Each town may determine its own procedures for appointment. The committee shall function as a standing Subcommittee of the South Shore Coalition, and shall report its findings and recommendations to the Coalition and to the participating towns.

It is further agreed that this memorandum may be amended from time to time by agreement of the signatories. Such amendement may provide for participation by representatives of other adjacent municipalities.

Dated:

For the Town of Cohasset
Board of Selectmen _____

For the Town of Duxbury
Board of Selectmen _____

For the Town of Hanover
Board of Selectmen _____

For the Town of Hingham
Board of Selectmen _____

For the Town of Hull
Board of Selectmen _____

For the Town of Norwell
Board of Selectmen _____

For the Town of Marshfield
Board of Selectmen _____

For the Town of Rockland
Board of Selectmen _____

For the Town of Scituate
Board of Selectmen _____

For the Town of Weymouth
Board of Selectmen _____